Manitoba

Annual Report 1985 - 86

Energy and Mines

Manitoba

Minister of
Energy and Mines

Room 301
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-4601

The Honourable Pearl McGonigal
Lieutenant Governor of the Province of Manitoba

May it please your Honour:

I have the honour of presenting to you the Annual Report of the Department of Energy and Mines for the fiscal year ending March 31, 1986.

This report records the activities of the Department and the performance of the mineral resources and energy sectors of the province during the year.

Wilson D. Parasiuk
Minister

Manitoba

Deputy Minister of
Energy and Mines

Room 301
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

(204) 945-3130

The Honourable Wilson Parasiuk
Minister of Energy and Mines

Dear Sir:

I have the honour to present the Annual Report of the Department of Energy and Mines for the fiscal year ending March 31, 1986. The report contains a descriptive and statistical record of activities and achievements in the mineral and energy sectors during the year.

Charles S. Kang
Deputy Minister

Table of Contents

TITLE	PAGE
Department of Energy and Mines	7
Energy Management	9
Cut Home Energy Costs (CHEC)	9
Home CHEC-Up	9
Business CHEC and Community CHEC	9
Manitoba Energy Audit Program	9
Community-Based Organizations: Energy Conservation Projects	9
Hydrogen Development Program for Manitoba	10
Ethanol from Cellulose	10
IPACE Alternate Fuels Study	10
Bristol Aerospace	10
Conservation and Renewable Energy Demonstration Agreement (CREDA) and ENERDEMO Agreement	11
Manitoba Energy Council	12
Geological Services	13
Lynn Lake	13
Flin Flon	15
Southeast Manitoba	16
Thompson	16
Gods - Island Lakes	16
Manitoba General	17
Remote Sensing	17
Meeting with Industry	17
Mineral Exploration Liaison Committee	17
Applied Geoscience Research	17
Analytical and Geochemical Laboratory	18
Editorial and Cartographic Services	18
Rock Preparation Laboratory	18
Geological Survey of Canada	18
Mines	19
Mining Recording	19
Aggregate Resources	19
Exploration Services	19
Mining Engineering and Inspection	20
The Mining Industry	21
Mineral Production	21
Mining and Processing Operations	21
Precious Metals	25
Industrial Minerals/Structural Materials	26
Mineral Exploration	26

TITLE	PAGE
Petroleum	28
Administration	28
Geology	28
Engineering and Inspection	28
The Petroleum Industry	29
Crown Oil and Natural Gas Lease Sales	29
Crown Oil and Natural Gas Leases	29
Revenue to Freehold Mineral Owners	29
Geophysical Activity	29
Drilling Activity	29
Production	31
Oil Prices	31
Value of Production	32
Provincial Revenue from Oil Production	32
Municipal Tax Assessments	32
Surface Owners	32
Oil Price Supplement Programs	32
Manitoba Drilling Incentive Program	33
Waskada Gas Plant	33
Petroleum Industry Employment	33
Industry Expenditure	33
Oil Reserves	34
Oil and Natural Gas Conservation Board	35
Policy Planning and Project Development	36
Energy Policy	36
Mineral Policy	36
Financial and Administrative Services	37
Financial Services	37
Personnel, Payroll and Operations	37
Information Systems	37
Data Processing	37
Word Processing	37
Library	37
Communications and Community Relations	38
Public Information	38
Support for Other Branches	39
Support for Reporting Agencies	39
Internal Communication	39

Statistical Supplement 1985/86

	TITLE	PAGE
Table 1	Energy and Mines Expenditure Summary Year Ended March 31, 1986	40
Table 2	Revenue from Mining and Quarrying (to March 31)	41
Table 3	Mineral Dispositions in Good Standing at Calendar Year End 1982 to 1985	42
Table 4	Mineral Dispositions Issued each Calendar Year 1982 to 1985	43
Table 5	Comparison of Manitoba Mineral Production and Value 1984 and 1985	44
Table 6	A Comparison of Value of Manitoba Metals, Industrial Minerals, Fuels and Total Mineral Production from 1973-1985 (Calendar Year)	45
Table 7	Manitoba Petroleum Statistics 1976-1985 (Calendar Year)	46
Table 8	Summary of Crude Oil and Salt Water Production — All Fields	47
Table 9	Crude Oil Sales; Transporters' Deliveries 1985	48
Table 10	Summary of 1985 Petroleum Geophysical Programs	49
Table 11	1985 Petroleum Drilling Statistics	50
Table 12	1985 Annual Oil Production	51
Table 13	Publications	52
Table 14	Energy Consumption by Type of Fuel, Manitoba 1983-1985	59
Table 15	Energy Consumption by End-Use Manitoba 1983-1985	59
Table 16	Canada/Manitoba ENERDEMO Agreement — Summary of Expenditures by Project	60

Department of Energy and Mines

Manitoba is endowed with substantial mineral and energy resources. The development of these resources and subsequent production into commercially attractive and marketable commodities underpins a large part of the socio-economic fabric of the province. On-going extractions of mineral resources and generation of electricity from hydro resources play an important role in sustaining economic growth of the province. These resources are viewed as a natural heritage which must be prudently managed, and developed under responsible policy guidelines to ensure that residents of the province, today and in the future, will benefit.

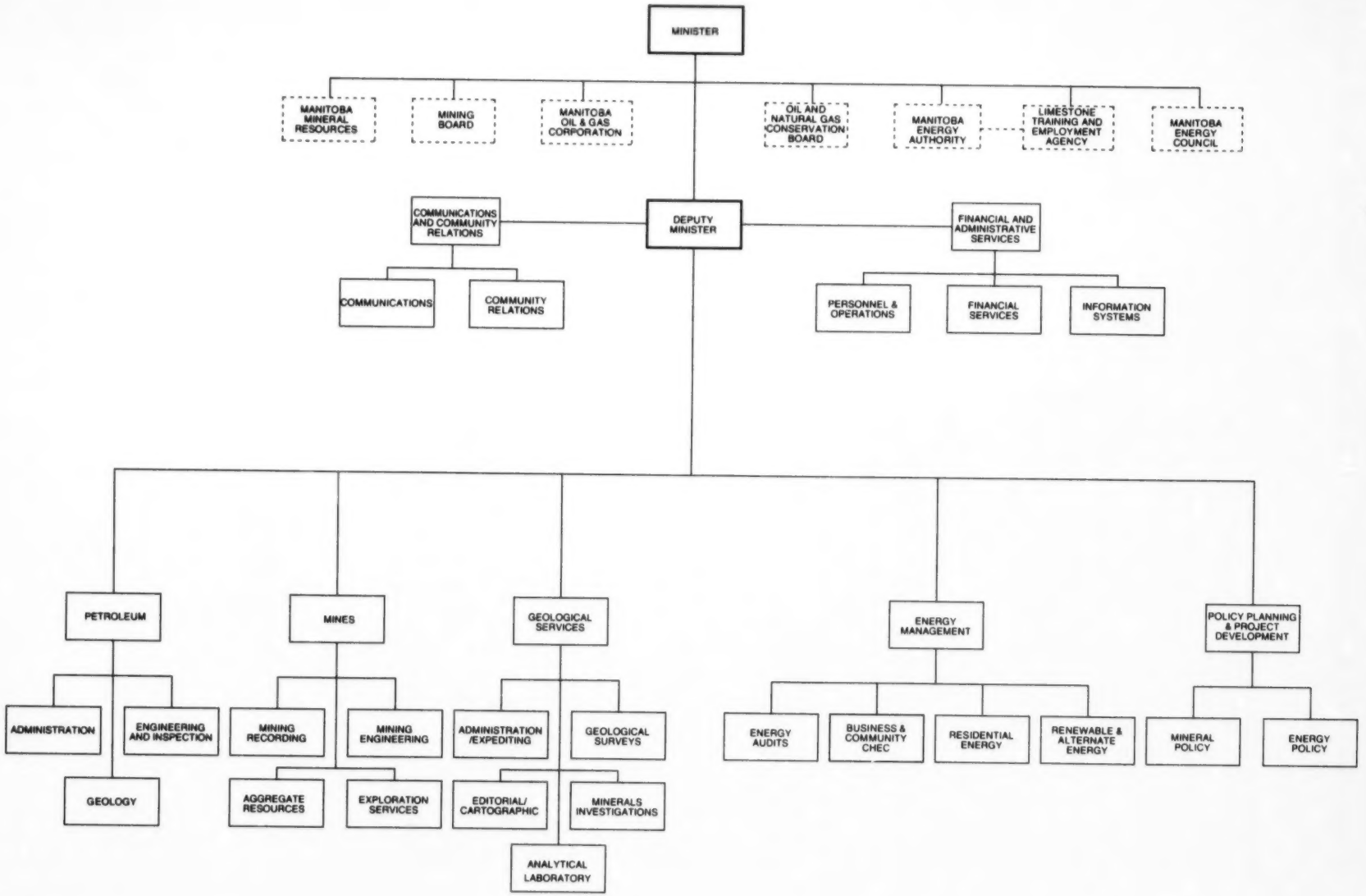
The Department has policy responsibilities in the case of hydro-electric energy and both legislative and policy responsibilities in the case of minerals, to ensure Manitoba's resources are developed and utilized in a manner which is beneficial to all residents, both the general public and corporate citizens.

The medium and long-term direction of the Department in addressing its mandate is to ensure continuity and enhancement of benefits from provincial mineral and energy resources.

During the year these functions were carried out by five main Branches — Energy Management, Geological Services, Mines, Petroleum, and Policy Planning and Project Development — with supporting Financial and Administrative Services and Communications and Community Relations. Additionally, the Minister held responsibility for the following Crown Corporations and Boards: Manitoba Mineral Resources Ltd., Manitoba Oil and Gas Corporation, The Mining Board, The Oil and Natural Gas Conservation Board, Manitoba Energy Authority and Manitoba Energy Council. Manitoba Mineral Resources Ltd., Manitoba Oil and Gas Corporation and Manitoba Energy Authority produce their own annual reports.

A summary of expenditures of the Department for the year ending March 31, 1986 is given in Table 1.

Organization Chart — Manitoba Energy and Mines



Energy Management

The Energy Management Branch is charged with planning, developing, implementing and monitoring programs and projects to demonstrate and foster energy conservation and the use of renewable and alternative forms of energy. The Branch also is represented on inter-provincial energy sub-committees and is responsible for the implementation of federal-provincial energy conservation agreements.

In response to the Branch's mandate to promote energy conservation to the advantage of all sectors of the Manitoba economy, the following programs and projects were undertaken during fiscal 1985/86.

Cut Home Energy Costs (CHEC)

The Cut Home Energy Costs program is designed to encourage the conservation of energy in residential heating. CHEC provides homeowners with a loan of up to $1,000 for labour and materials to pay for home energy retrofits. The loan, at an interest rate of 9-1/2% for a five year term, is repayable over a maximum of twenty years by monthly installments on the homeowner's hydro bill. CHEC not only promotes energy conservation, but also creates employment in the province's energy retrofit and building trades industries.

For the fiscal year 1985/86, 5,148 loans were disbursed valued at $4,301,800. Funding for the loans is provided by the Manitoba Jobs Fund, while the program is administered by Energy and Mines and delivered by Manitoba Hydro and Winnipeg Hydro.

Home CHEC-Up

In response to a growing need for impartial advice for homeowners wanting to conserve energy the Home CHEC-Up program was announced February 9, 1984. Trained energy advisors visit the homeowners to review energy use in the home and recommend economic energy conservation measures. The homeowner is charged $20 for this service and this fee is refunded if any of the recommended conservation measures are undertaken within a year.

Funding was provided by the Manitoba Jobs Fund, while the program is administered by the Department of Energy and Mines and delivered by Manitoba Hydro.

In the fiscal year 1985-86, 2,986 homes were audited.

Business CHEC and Community CHEC

Cut High Energy Costs is an energy conservation grant program designed to assist Manitoba's small businesses (Business CHEC), and municipalities, institutions and non-profit organizations (Community CHEC), to undertake energy retrofits. One time only, matching grants of up to $15,000 are provided to participants whose latest one-year energy bills total less than $100,000 but are greater than $5,000.

The cost of the retrofit work up to $30,000 is borne equally by the participant and the CHEC programs. Retrofit costs exceeding $30,000 are the sole responsibility of the participant.

In the fiscal year 1985/86, 135 projects were completed. Grants and interim payments amounted to $1,215,204 for work completed in the fiscal year. The program is funded by the Manitoba Jobs Fund and administered by the Department of Energy and Mines.

Manitoba Energy Audit Program

The Energy Audit program had initially been undertaken as a cost-shared Manitoba/Canada program under the original Energy Bus Agreement (1980-82) and the National Energy Audit Program (NEAP 1982-84). With the expiry of the NEAP Agreement the program and equipment came under sole control of Manitoba.

With the use of two energy audit vehicles, complete with computer systems and instrumentation, on-site energy audits were provided to 196 facilities, identifying $2 million worth of potential energy savings.

Since the beginning of the program in November 1980, over 1,000 facilities have been audited, identifying over $16 million dollars worth of potential savings.

During the last year a computerized data base for all energy audits was created which allows the energy use statistics of all facilities audited to be retrieved and analyzed.

Community-Based Organizations: Energy Conservation Projects

The objective of this program is to stimulate energy conservation and create employment opportunities for minorities and special interest groups by making grants available to non-government organizations active in energy conservation and alternative energy services.

By the end of the fiscal year three projects were undertaken under this program: The Kinew Energy Program, Age and Opportunity Centre, the Association for Community Living — Manitoba.

Funding for the following projects was provided by the Manitoba Jobs Fund and they were administered by the Department of Energy and Mines:

1. **Kinew Housing** is a non-profit housing corporation that provides low-cost rental accommodation to native families. The Kinew Energy Program funds upgrading and retrofitting of Kinew's homes to reduce energy bills and thus provides a major saving for their low income tenants. The program also provides training for native people to enhance their job opportunities in the retrofitting and construction industries. For fiscal year 1985/86, 76 homes were retrofitted for a total expenditure of $125,000.
2. **The Age and Opportunity Centre** has established an energy conservation program designed to assist elderly residents to upgrade the energy efficiency of their residences. The program employs an energy coordinator who visits seniors and provides energy advice and assistance on a one-to-one basis. In the fiscal year 1985/86, 154 homes were audited for a total expenditure of $26,765.
3. **Association for Community Living** has established a program designed to assess the energy efficiency of the 46 group homes of the Association, as well as to provide some financial assistance for undertaking some energy retrofit work. In the fiscal year 1985/86, 11 group homes were retrofitted for a total expenditure of $53,519.

Hydrogen Development Program for Manitoba

A $72,000 study was carried out by the Hydrogen Industry Council and its sub-contractor, W.L. Wardrop and Associates Limited of Winnipeg, to identify and analyze hydrogen opportunities for Manitoba. The scope included local markets and international market opportunities. A number of interesting project areas were identified, including hydrogen peroxide production, electroorganic synthesis, flue gas desulphurization and plasma processes. No economical near-term developments were identified.

Ethanol from Cellulose

Using grains as a feedstock is not economic for a small ethanol plant such as the one at Minnedosa, but the use of aspen or other lignocellulosic material offers the potential for producing ethanol at a competitive price. The key to the success is the sale of by-product lignin as a chemical product. The feasibility study for a cellulose "front end" for the Mohawk Minnedosa plant is the subject of a $237,150 project that is jointly funded by the Monencolotech Corporation, Canada and Manitoba. The design is based on the results from the 1 ton/day pilot plant operated by Monenco and Iotech in Ottawa.

The feasibility study will identify the operating and revenue requirements for two cases of expansion to wood use at Minnedosa: throughputs of 60 tons per day and 120 tons per day of wood. The latter case matches present fermentation and distillation capacity at Minnedosa and would allow for complete substitution of grain with aspen wood. The report will be completed by June 1986.

IPACE Alternate Fuels Study

Manitoba provided $2,000 towards a $40,000 study to compare the costs of conventional and alternative transportation fuels. The other participants in the study were Quebec, Ontario, Alberta, Yukon, the North West Territories and Canada. Canadian Resourcecon Limited of Vancouver was the contractor and Manitoba was the project manager.

The fuels that were compared were gasoline from conventional reserves and from oil sands, diesel, propane, natural gas, methanol, ethanol and alcohol blends with gasoline. The study provided production, distribution and use costs for these fuels, both with and without taxes and subsidies, over a time period from 1985 to 1995.

This information will assist in assessing the need for and planning the degree of government involvement in the development of alternative fuels.

Bristol Aerospace

Bristol Aerospace Limited received $87,500 from the province to assist in the installation of a $625,000 energy-efficient dual fired boiler system for space and process heating at the company's Winnipeg plant. The boilers, which can use either natural gas or electricity, replaced less efficient boilers that burned higher cost Bunker "C" oil as fuel.

The federal government provided a matching grant of $87,500 under the ENERDEMO Canada Program.

Conservation and Renewable Energy Demonstration Agreement (CREDA) and ENERDEMO Agreement

The CREDA program terminated on March 31, 1985, after a one year extension. Further funding for outstanding capital works, monitoring and report publishing for projects arising out of CREDA, was provided under a joint federal/provincial ENERDEMO Agreement. The expenditures in 1985/86 came to $461,434.

ENERDEMO projects funded in fiscal year 1985/86 are listed in Table 16.

Manitoba Energy Council

The Manitoba Energy Council is a citizen advisory group appointed by the Minister. The Council consists of a Chairperson, Secretary and eight members. The Council provides the Minister with assessments and recommendations concerning energy policy and conservation programs.

Geological Services

The Geological Services Branch comprises four sections: the Geological Survey Section, the Mineral Investigations Section, the Analytical Laboratory Section and the Editorial and Cartographic Services Section.

The Geological Survey and Mineral Investigations Sections undertake geological mapping, mineral deposit studies and other geoscientific investigations designed to provide an up-to-date geological framework and mineral data base for the province for use in mineral resource appraisal, land-use planning and in addressing environmental concerns.

The Analytical Laboratory Section provides the necessary analytical support for the Branch's geological and mineral evaluation activities. The Editorial and Cartographic Service Section is responsible for the drafting and preparation of all maps, graphs, charts and illustrations for the Mineral Resources Division and the editing of all Branch publications and reports.

During 1985, governmental geoscientific activities in Manitoba were again facilitated, coordinated and funded under the Canada-Manitoba Mineral Development Agreement (1984-89), a sub-agreement under the Economic Regional Development Agreement (ERDA). Under the terms of the Agreement, Canada and Manitoba will spend a total of $24.7 million to implement geological, geophysical and geochemical surveys, research into mining and processing technology improvement, marketing and other mineral economic studies in order to improve the level of effectiveness of mineral exploration; to investigate potential new developments that could lead to a diversification of the provincial mineral base and to improve the efficiency of mining and processing operations in the province.

The 1985/86 Workplan for Sector 'A' Geoscientific Activities identified 60 provincial and 20 federal projects, including projects to be contracted to universities in Manitoba and elsewhere in Canada. Copies of the Workplan were forwarded to the newly constituted Mineral Exploration Liaison Committee in March 1985 to solicit feedback that might be incorporated into this year's field program. At the outset of the field season, a 5-day demonstration and field tour was given for the benefit of industry, federal government and other provincial geologists working along the Kisseynew metallotect north of Flin Flon. Subsequent tours of shorter duration were led by provincial geologists in the Cross Lake area, in the Pikwitonei region and at Snow Lake.

A progress report covering all aspects of MDA geoscientific programs during the 1984/85 fiscal year was released in September 1985. In subsequent years it is intended that similar progress reports will be released in late spring, prior to the onset of the field season.

Lynn Lake

As in previous years, heavy emphasis was placed on assisting the search for new ore deposits in the Lynn Lake and Flin Flon regions and on raising the level of exploration elsewhere in the province. A substantial data base has been generated in the Lynn Lake region over the past 10 years and an intensive effort is now underway to analyze and process the data for publication. Open File reports on basal till investigations and biogeochemical surveys over the Agassiz metallotect were released in the fall of 1985 as was a detailed report on the geochemistry of the volcanic rocks in the Lynn Lake greenstone belt.

Geophysical data stemming from GSC-sponsored gradiometer surveys of the Ruttan district and Fox Mine area are currently being processed and will be released as 1:20 000 scale contour maps and 1:50 000 scale colour applicon plots in the spring of 1986.

Work is continuing on the 1:250 000 scale synoptic geological compilations for the Granville and Ulhman Lakes sheets (NTS 64C and B) as well as a report on the Brochet and Big Sand Lake area (NTS 64F and G) immediately north of Lynn Lake. Reports and maps are also under development for the Barrington, MacMillan, Kamuchawie and Eden Lakes areas, as well as a detailed investigation of metavolcanic rocks of the Ruttan district.

Uranium/lead isotope studies conducted by the federal and provincial surveys in this part of the Churchill province have been extended through cooperative work with the University of Kansas (supported by the National Sciences Foundation). Work by the GSC and the provincial Survey identified two distinct ages of volcanism. This is of significance to the ongoing tectonic and stratigraphic analysis of the area and will be a key element in unravelling the region's metallogeny.

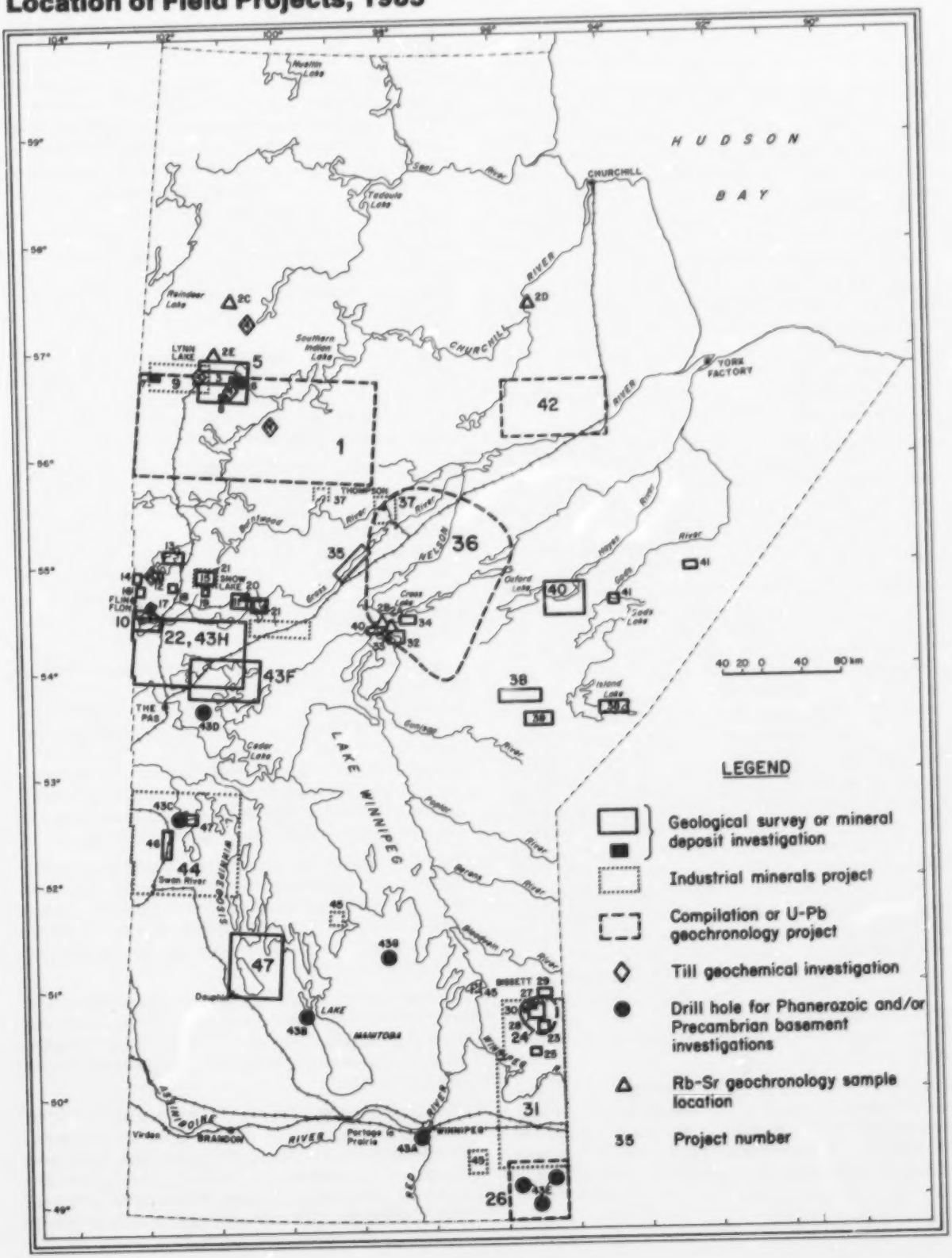
New rubidium/strontium results from the Chipewyan batholith and Goldsand Lakes region confirm observations that the paragneisses and associated intrusions of the Southern Indian Lake domain predate emplacement of the intrusive phases of the Chipewyan batholith.

Mineral deposit documentation was undertaken in the area between Lynn Lake and Barrington Lake. Detailed mapping and geochemical studies of the 'Lar' massive sulphide deposit and Cartwright Lake gold occurrence were completed.

Investigations along the Agassiz metallotect included geological mapping of known gold occurrences, lithogeochemical sampling of Agassiz-type rocks, and a regional basal till study. These studies confirm the presence of Agassiz-type rocks in the Nickel Lake area and re-affirm the 60 km strike length of rock units with a potential to contain gold deposits.

Map 1

Location of Field Projects, 1985



Map Legend

Lynn Lake Area

1. Geological compilation and geochronology
2. Rubidium-strontium geochronology
3. Agassiz metallotect till sampling
4. Till investigations, Ruttan
5. Mineral deposit investigations
6. Nickel Lake geology and mineral occurrences
7. Lar deposit alteration study
8. Cartwright Lake geology
9. Industrial minerals evaluations

Flin Flon - Snow Lake

10. Athapapuskow geological mapping
11. Chisel-Reed Lakes geological mapping
12. Kisseynew project; geological mapping
13. Kississing Lake geological mapping
14. Kississing Lake-west geological reconnaissance
15. Mineral occurrences in the Kisseynew region
16. Tartan Lake geology
17. Baker Patton and Centennial deposit geology
18. Vamp Lake geology and mineralization
19. North Star Lake mineral deposit geology
20. Snow Lake mineral deposit geology
21. Snow Lake industrial minerals
22. Sub-Paleozoic investigations

Southeast Manitoba

23. Stormy Lake geological mapping
24. Zircon geochronology
25. Cat Creek geological mapping
26. Sub-Quaternary geological investigations
27. Rice Lake mineral deposit investigations
28. Mineral occurrence documentation, Rice Lake
29. Mineral deposit investigations, Wallace Lake
30. San Antonio Mine, fluid inclusion studies
31. Dimension stone evaluation

Thompson

32. Geological mapping, Cross Lake
33. Geological mapping and sampling, Pipestone Lake
34. NE Cross Lake geological mapping
35. Phillips Lake geological mapping
36. Zircon geochronology
37. Industrial minerals evaluation

Gods-Island Lake

38. Geological mapping, Island-Stevenson Lakes
39. Geological mapping, Knight-Bigstone Lakes
40. Pegmatite evaluation, Knee-Magill Lakes
41. Pegmatite evaluation, Gods-Red Cross Lakes
42. Limestone River compilation

Southeast Manitoba

43. Stratigraphic mapping and drilling
44. Swan Lake industrial minerals
45. Industrial minerals, southern Manitoba
46. Porcupine Hills landslide study
47. Paleozoic lead-zinc evaluation

Metamorphosed alteration zones in the Laurie Lake area were mapped and sampled as potential sources of abrasive and refractory minerals.

Case studies of glacial dispersion haloes were undertaken near Ruttan, Dot Lake and Le Clair Lake.

Flin Flon

A geological reconnaissance of the Athapapuskow Lake area confirmed the desirability of 1:20 000 scale geological mapping and geochemical work to upgrade the existing mapping and permit a stratigraphic analysis of the stratabound mineral occurrences. Initial findings suggest that major faults disrupt the Amisk Group successions, juxtapose blocks of widely differing metamorphic grade and in some cases appear to be the loci of gold mineralization. A zone characterized by low metamorphic grade (prehnite-pumpellyite) was traced from the Schist Creek/West Arm area to Hook Lake.

A reconnaissance of the Snow Lake region confirmed the need for 1:20 000 scale mapping of a burnt-over area between Chisel and Morgan Lakes. The area contains seven significant volcanogenic massive sulphide deposits and detailed maps are required to define the extent and degree of hydrothermal alteration zones as well as the stratigraphy of the volcanic rocks.

North of Flin Flon, on the south flank of the Kisseynew belt, a new 1:20 000 mapping program has been initiated to resolve the stratigraphy of the paragneissic sequences and provide additional information on the nature and location of the Kisseynew metallotect.

Shallow dipping paragneissic sequences and amphibolites were traced westwards along Kisseynew Lake into equivalent formations documented in Saskatchewan. Amphibolites, encountered at several levels in the sequence, commonly contain sulphide mineralization. A domal gneissic complex south of Weasel Bay possesses a unique granulitic aspect that is typical of the Archean Pikwitonei region rather than the Hudsonian assemblages of the Churchill Province. Uranophane-bearing pegmatites were also encountered near the Saskatchewan border.

Detailed geological mapping was initiated in the Big Island area on Kississing Lake, and earlier work near Lobstick Narrows was also continued. Both projects

are encountering a much greater diversity of rock types and structure than was previously anticipated, factors which will inevitably impact on the conduct of future surveys in this region.

South of Flin Flon, an additional 16 holes were drilled through the limestone as part of the Province's contribution to sub-Paleozoic investigations in the Project Cormorant area. The GSC has initiated a compilation of all information from the southern half of NTS area 63K, including complete re-logging of all available exploration drill core and provincial "Scout" drill core, and correlation with gradiometer, total field and VLF data.

Documentation of mineral occurrences in the Flin Flon region proceeded in the Snow Lake and North Star Lake areas. In-depth studies of alteration zone geochemistry were initiated in the Snow Lake area to establish parameters for base metals exploration. At Flin Flon, selected mineral occurrences such as the Vamp deposit, the Tartan Lake gold deposit, the Centennial Mine and the Baker Patton copper-zinc deposit, were mapped thematically to resolve metallogenic problems identified during work in 1984.

Detailed 1:5000 mapping and investigations of gold occurrences in the Kisseynew metallotect re-affirmed the stratigraphic nature and regional extent of gold-bearing strata within parts of the Kisseynew terrain.

Known occurrences of garnet, staurolite, kyanite and sillimanite in the Star and Snow Lake areas were mapped in detail and sampled as potential sources of abrasives and refractory materials.

Southeast Manitoba

In the Rice Lake greenstone belt, 1:10 000 scale mapping in the Stormy Lake area added a new unique stratigraphic marker at the boundary between felsic volcanic rocks, and metasediments that contain gold and stibnite mineralization. Favourable hosts for gold mineralization are carbonated and silicified shear zones in gabbroic rocks. A U/Pb zircon geochronological program conducted through the University of Windsor, Ontario, has yielded results suggesting the felsic volcanic and intrusive rocks are comagmatic and relatively young for northwest Superior Province greenstone belts.

In the Cat Creek area, much improved access along timber-cutting roads facilitated detailed geological mapping and the discovery of several layered magnetite- and olivine-bearing pyroxenite sills within the volcanic sequences.

Several "Scout" drill holes in the Whitemouth area permitted sampling of magnetic anomalies in the Precambrian basement beneath thick Quaternary cover.

Mineral investigations in southeast Manitoba resulted in detailed mapping of iron formations in the Wallace Lake area to assess their potential as hosts to gold mineralization. Mineral occurrences in the area east of the San Antonio Mine were documented and sampled to establish the geological setting of gold and base metal mineralization.

A dimension stone survey initiated in the region south of the Winnipeg River provided background data for the preparation of a promotional brochure on building stone potential in that part of the province.

Thompson

In the Cross and Pipestone Lakes area, mapping confirmed the presence of subaerial-fluvial metasediments overlying an older volcanic sequence. Geophysical surveys, detailed mapping and sampling of an elongate gabbro-anorthosite complex traced magnetite-bearing layers to the east channel of the Nelson River, thereby extending the vanadium and titanium potential significantly. Analyses to date indicate high niobium contents associated with the higher vanadium values.

Uranium/lead isotope investigations in the northwest Superior Province yielded a precise age for the end of the Hudsonian overprint in the Thompson belt, and confirmed an early Proterozoic age for granitoid plutons in this belt and their derivation from Archean precursors. Preliminary ages from the Pikwitonei domain confirm the relatively young age of the granulite metamorphism.

Mapping at Phillips Lake confirmed that leucogneiss is retrogressed from felsic granulites and that granulitic domains survived the otherwise intense Proterozoic deformational and metamorphic overprint.

To the northeast and north of the Nelson River a regional compilation project completed documentation of bedrock occurrences in the sparsely exposed northern half of NTS area 54D. Proterozoic sequences equivalent to those occurring on Assean Lake and near Rock Lake were documented north of a prominent cataclastic zone marking the boundary between the Churchill and Superior Provinces.

Industrial mineral investigations in the Thompson area delineated sources for carving, building and ornamental stones.

Gods-Island Lakes

Regional greenstone mapping in the Island Lake area was completed with mapping at Stevenson, Knight and Wass Lakes. Stratigraphically, Knight Lake is a continuation of the Bigstone Lake succession. Felsic volcanic rocks mapped near the major northwest-trending

fault zone are now viewed as silicified mafic flows. Assay data from Bigstone Lake yield significant zinc and precious metal values.

North of Loonfoot Island (Island Lake) a large slightly differentiated gabbro intrudes the youngest Hayes River Group. South of Savage Island abundant iron formation was mapped. Along the southern contact of the greenstone belt hornblendite and serpentinite related to olivine gabbro norite may be metallogenically significant.

Rare-element pegmatite studies were completed on Cross Lake. On Magill Lake a lithium-enriched halo associated with granite is dispersed to the west and northwest. Two dykes with spodumene and one beryl-bearing dyke were discovered.

Manitoba General

A regional industrial mineral resource program was initiated this year in the Swan River area (NTS 63C). Other industrial mineral activities in the southern part of the province continued evaluation of commodities such as silica sand, bentonite, kaolin, glauconite, gypsum and cement rock.

A basal till sampling profile was conducted along the Pelican Rapids Road as part of the ongoing search for lead-zinc mineralization in the Paleozoic. The study was augmented by geochemical analysis of Paleozoic drill core from five drill cores in the west-central part of the province.

Stratigraphic drilling in the Project Cormorant area confirmed the uniformity of the Precambrian erosion surface and overlying Phanerozoic strata. Structural trends on the Precambrian surface change gradually from 090° (in the east) to 070° (in the west). This northeast-trending synclinal flexure is coincident with the Churchill-Superior boundary.

Stratigraphic mapping and geochemical lake sediment sampling of the Moose Lake-Cormorant Lake area were completed.

Drilling in southeast Manitoba confirmed the eastward extension of deposits in a major Mesozoic channel within the Precambrian. Drilling at Dawson Bay confirmed the superficial local structural relief resulting from draping over the buried Winnipegosis reefs. Comparison of drill data with seismic profiles permits an evaluation of the complex velocity anomalies affecting seismic interpretation of the reef complexes.

The accelerated level of operations funded through the MDA permitted reactivation of the province's Mineral Inventory Project (dormant since 1979) as well as the development of a comprehensive bibliography on literature pertaining to Manitoba's geology and mineral resources.

Remote Sensing

The province's continuing evaluation of remote sensing as a tool for mounting a province-wide inventory of peat resources, this year completed pilot studies in southeast Manitoba. The joint peat study (Departments of Energy and Mines and of Natural Resources, and the Botany Department, University of Manitoba) continued classification of peatlands in the Lac du Bonnet-Sprague area. Peatland classification maps, data on bog thickness and a preliminary assessment of bog potential will be released as a report in 1986.

Stressed vegetation studies, resulting from metal concentrations in bedrock, have been initiated in cooperation with the Ontario Centre for Remote Sensing and the Department of Earth Sciences, University of Manitoba. Test sites at Flin Flon and Lynn Lake were scheduled for coverage in September, 1985 with data and image analysis proceeding thereafter.

Meeting with Industry

The results of the 1985 field program were reported at the annual Meeting with Industry in Winnipeg on November 19th and 20th (270 registrants). A report of Field Activities (260 p.), sixteen Preliminary Maps, and four other technical reports were released at the meeting, which included displays and talks on various aspects of the provincial, federal and university programs.

Mineral Exploration Liaison Committee

The first formal meeting of the Mineral Exploration Liaison Committee was held on November 21st to invite comment from industry on the acceptability of the programs, as well as suggestions for new initiatives or modifications to the existing format.

A subsequent letter from the regional representative of the PDA to the National President, PDA, endorsed the focus and scale of the programs and acknowledged the input of both federal and provincial agencies, indicating that "the program as a whole remain as planned and scheduled . . .".

Applied Geoscience Research

University participation in the conduct of MDA projects continues at a high level with eighteen research agreements, ten of which are with the University of Manitoba, the others with universities at Carleton, Western,

Waterloo and Windsor, and with the Royal Ontario Museum. Seven of the eighteen theses being developed in conjunction with MDA activities are with the University of Manitoba.

Geochronological and petrological contributions are also being made by the University of Kansas and geologists from NASA in Houston, Texas.

Analytical and Geochemical Laboratory

The Analytical and Geochemical Laboratories supported Manitoba prospectors and the Branch's geologists involved in mineral deposit studies and mapping, by providing assays, geochemical analyses or complete silicate analyses of their samples. In the 1985/86 fiscal year the Analytical Laboratory provided 8 800 assay determinations. As well, 11 708 silicate analyses and 45 spectrographic determinations were made. The Geochemistry Laboratory performed 64 069 geochemical determinations.

A state-of-the-art Varian AA40 atomic absorption spectrophotometer was purchased to give the laboratory a capability for fully automated analysis with reduced analytical time and greater detection limits.

The laboratory also acquired three computers to increase efficiencies in record-keeping and data reporting.

Editorial and Cartographic Services

Editorial and Cartographic Services are responsible mainly for advisory and technical services in all phases of preparation of geological reports for the Geological Services, Mines, and Petroleum Branches. Publications released during the 1985/86 fiscal year are listed in Table 13. Three of these reports are worth special note: the annual Report of Field Activities, 1985, containing 55 papers and 19 preliminary maps; Uhlman Lake 64B map sheet, the first map in the new Bedrock Geology Compilation Map Series (1:250 000); and Geological Report 80-9, Geology of the Cochrane and Seal Rivers Areas, which contains 8 maps covering the Precambrian Shield between latitudes 58° and 60°, from Hudson Bay to the western boundary of Manitoba.

In addition, numerous figures and diagrams were prepared for various internal reports; slides and display materials were prepared for public presentations by the minerals related branches.

Rock Preparation Laboratory

During the year ending March 31, 1986, the Rock Preparation Laboratory completed 2 348 thin sections, 143 stained slabs and 199 polished slabs. The laboratory also prepared 2 871 samples for chemical analysis.

The Rock Preparation Laboratory maintained one Precambrian rock and two petroleum core warehouses. Support also was provided for 60 requests from the petroleum industry to review core.

The Rock Preparation Laboratory was also involved in a summertime core hole program in which 23 holes were drilled for a total of 1 210 m. Of these, 16 were in the Project Cormorant area, 4 were for stratigraphic interpretation and 3 were in southeastern Manitoba for a Precambrian mapping project.

Geological Survey of Canada

Programs delivered by the Geological Survey of Canada included U/Pb isotope investigations, and detailed studies of alteration zones and assemblages in the Flin Flon and Lynn Lake areas (Linda-Nicoba deposits). Structural studies were initiated at the Pipe Pit and in southeast Manitoba, both in an attempt to define parameters controlling mineralization in these areas. Detailed property-scale mapping of chromitite seams and ultramafic phases was initiated in the Bird River Complex. Applied Geoscience Research projects conducted by the GSC and Department of Earth Sciences, University of Manitoba, continued work on the mafic and ultramafic intrusions of the Flin Flon belt as well as detailed mapping and petrological studies of the Falcon Lake Stock.

Metamorphic studies southwest of the Fox Mine on Laurie Lake are being conducted in cooperation with Queen's University.

Precious metals oriented investigations were continued in the Flin Flon belt as part of a broader metallogenic evaluation of mineralization in this region.

Gradiometer surveys, contracted to Kenting, were conducted in the Namew and Nokomis Lake regions and over the northern one-third of the Moose Lake area.

Regional lake sediment surveys covered most of the well exposed Kisseynew terrain in NTS areas 63N and 63-O/W1/2 as well as the Flin Flon greenstone belt in NTS area 63K/N1/2 and 63J/NW1/4.

Sampling and mapping of surficial deposits were completed for the northern half of the Uhlman Lake (64B) and Big Sand Lake areas. Airphoto interpretation of surficial deposits was extended into NTS areas 53E, L and K, with output intended at a scale of 1:250 000.

Mines

The Mines Branch, through the activities of its component sections, is responsible for administration of matters relating to the operation of mines, smelting and refining operations; recording of mineral dispositions; monitoring of exploration activities and reviewing assessment reports; the rehabilitation of mining lands; aggregate resource inventory studies; and the implementation of provincial land use policy concerned with the conservation of aggregate resources. During the year the Branch was also responsible for activities under Sector B of the Canada/Manitoba Mineral Development Agreement.

Mining Recording

The Mining Recording Section maintains recording offices in Winnipeg and The Pas to administer regulations under The Mines Act governing the disposition of Crown mineral rights other than oil and natural gas. The regulations enable individuals and companies to acquire claims, permits and leases for the right to prospect, develop and mine Crown minerals. The Mining Recorders and their staff process applications for these mineral dispositions; monitor and inspect the activities of disposition holders; collect fees, rents, royalties and refundable performance deposits; maintain records; and deal with enquiries relating to these functions.

During calendar year 1985, 783 mining claims were recorded covering a total area of 136 736 hectares, compared with 201 058 hectares in 1984. Mineral dispositions in good standing at the end of 1985 are given in Table 3. Details of Crown mineral dispositions issued during 1985 are given in Table 4.

Total revenue collected by the Section during the fiscal year was $1,997,848, comprising $1,369,899 from dispositions, other fees and rentals; $76,723 from The Mining Claim Lease Tax; and $551,226 from royalties on industrial minerals (see Table 2).

Royalties from industrial minerals production remained relatively unchanged ($551,226 in 1985/86 compared with $554,352 in 1984/85) reflecting little change in activity in the construction industry.

Aggregate Resources

The Aggregate Resources Section undertakes detailed surficial geological mapping, aggregate resource inventories and prepares quarry mineral land use recommendations based upon provincial land use policies. Resource inventory data and resource management proposals are provided to government, municipalities and private sector users.

Economic evaluations of sand and gravel deposits were undertaken by staff geologists in the Rural Municipalities of Roblin, South Norfolk, Shellmouth and the Local Government District of Reynolds. Mapping of surficial geology and an aggregate resource inventory of the Rural Municipality of Shell River were undertaken by Underwood McLellan Limited under contract to the Mines Branch.

In response to requests from Municipal Planning Districts, recommendations for the protection of quarry mineral resources were presented to the Rural Municipalities of Russell and Wallace. The mineral resource planning recommendations were supported by technical background reports and maps illustrating the proposed planning status of each economic quarry mineral deposit. One presentation was made to the Rural Municipality of Daly. A total of 456 land subdivisions were reviewed of which 26 subdivisions conflicted with mineral extraction and required detailed evaluation by staff geolgoists. All proposed Crown land transfers and zoning by-law amendments were reviewed and where necessary, recommendations made to minimize potential conflicts with mineral extraction. Staff geologists maintain representation on all Regional Land Use Committees and serve on a variety of techical advisory review committees.

Five geological reports, two geological maps, three preliminary maps, three internal resource management reports and one educational series were released during the year. Publications, preliminary maps and presentations by Section staff are listed in Table 13.

Exploration Services

The Exploration Services Section, comprised of eight professional (three term) and two clerical staff, provides support to mining companies and prospectors engaged in mineral exploration in Manitoba. The Section monitors, promotes and documents exploration activity in the Province; examines assessment work on mineral dispositions for compliance with the regulations under The Mines Act and disseminates non-confidential data; distributes geological publications; collects and stores diamond drill core; compiles and disseminates exploration and mineral deposit data; prepares interpretative geophysical maps of active exploration areas; compiles bibliographies and indexes to Manitoba geology; and performs land use, mineral potential studies. The mineral inventory, bibliographic and expanded drill core collection projects are currently being conducted by three term geologists under the Canada-Manitoba Mineral Development Agreement, 1984-89.

During the fiscal year, 254 reports of exploration work were received and assessed; 622 files were

microfilmed; 54 reports were added to the non-confidential files; 791 files were reproduced for the private mining sector; 2 350 open files were examined by mining industry personnel, 1 100 by staff, and 307 visits were made by mining company personnel. The master "Index to Non-confidential Assessment Reports," compiled from the CLASS computer file of exploration data, was updated by supplements issued in May and November. Index maps showing the areal extent of non-confidential exploration work were updated.

During the year 1 063 orders for geological publications and maps were filled, generating $13,589.60 in revenue, up 17% from 1984/85. Publication release notices for 25 new publications were mailed to the 600 addresses on the mailing list. Eighteen orders for over 800 mineral inventory cards and 35 corporation files were filled.

Exploration activity summaries were compiled for the Northern Miner and the annual Prospectors and Developers Association Convention. Displays depicting the work of the Section, the Geological Branch and exploration in the province were presented at the Annual Meeting with Industry, the Prospectors and Developers Annual Convention in Toronto, the Manitoba Schools Career Symposia in Winnipeg and Brandon, Norway House Career's Day, and the Winnipeg Gem and Mineral Show. Presentations by three Section geologists were given at the CIM District 4 Annual Meeting and staff served on the Executive of the CIM Winnipeg Branch. Three members of the Section attended the annual Prospectors Convention in Toronto to set up and staff the geological-mining display and to assist with the province's hospitality suite for the purposes of promoting mining investment in Manitoba. Staff members of the Section spent 586 person days in the field, in large part liaising with exploration industry personnel. Two members served on the Mineral Exploration Liaison Committee which was established in 1985 to involve industry in the planning and monitoring of programs under the Mineral Development Agreement.

A total of 33 979 metres of core was collected in 29 separate field retrievals in northern Manitoba during the year under the diamond drill core acquisition and storage program. As of March 31, 1986, the province's drill core inventory was approximately 214 000 metres, stored at four regional core libraries — Lynn Lake (45 190 metres), The Pas (89 166 metres), Thompson (54 139 metres) and Winnipeg (25 506 metres). Library improvements and reorganization projects were completed in all buildings and selective reduction of core from high density drill projects resulted in the removal of 11 851 metres from the system. A highly efficient computerized core box labelling system was developed and the manual N.T.S.-based data files on all holdings were updated. Core is provided on a voluntary basis by mineral exploration companies and prospectors who, in turn, receive assessment work credits for the transportation costs. The non-confidential core is available for examination, thereby eliminating the need for costly duplication of diamond drilling, and allowing for more productive use of exploration dollars. There were 29 inspection visits at the core libraries during the year consisting of 78 days of use and the examination of 8 840 metres of core. Publication of an attractive bilingual brochure on the Libraries Program as well as advertisement at the Prospectors and Developers Convention, Annual Meeting with Industry and in the Report of Field Activities have served to increase industry awareness and interest in this service.

The Section's geophysicist conducted geophysical interpretation studies from the assessment data on the Island Lake area and for updating his previous 1978 publication on the Flin Flon-Snow Lake district. He prepared, for publication in the Canadian Mining Journal, a paper on the interpretation of gradiometer surveys over the thin Paleozoic covering the Flin Flon belt. A ground magnetic survey was carried out in the Maskwa area and a comparative susceptibility study with gradiometer data was completed.

Work was finished on revising and updating the Educational Series Publication "Copper and Zinc in Manitoba." An open file on the "Gold Mineral Inventory Update of the Rice Lake Greenstone Belt" was released. A bibliography of all provincial and federal geoscientific publications on Manitoba was completed in manuscript form using an interactive computer data base. Informational pamphlets to assist industry and the public seeking exploration services in the province were updated and printed. The Education Series Publication "Mining in Manitoba" was brought to the manuscript phase by year end.

The Section was responsible for examining land-use requests in order to avoid future conflicts in areas of high metallic mineral potential; 27 such land-use clearances were examined. Mineral potential, land-use designation and mineral property maps were prepared in response to specific requests and staff served on land-use committees.

Mining Engineering and Inspection

Visits were made on a regular basis to the underground mines in the province to monitor their operation. Special emphasis was placed on two operations which received financial aid from the Government of Manitoba, SherrGold Inc.'s MacLellan mine near Lynn Lake and the Ruttan mine of Sherritt Gordon Mines Limited.

A total of 3 308 inspections were made of pits and quarries to monitor compliance with the regulations, reporting of material removed and rehabilitation measures.

During the year, 567 Casual Permits and Permissions to Remove Crown Quarry Minerals were issued. In addition, technical advice on mining and rehabilitation practices was provided to the industry and other government agencies.

A considerable amount of time and effort were directed to a Technical Advisory Committee which reviewed The Proposed Regulation Concerning The Rehabilitation Of Pits and Quarries. This regulation is still under review.

Implementation of the Mining and Minerals Technology Research and Development segment of the Canada-Manitoba Mineral Development Agreement continued. Approximately $400,000 was expended on ten provincially-funded projects of which six were contracted with Manitoba mining companies, one with the University of Manitoba and two with consulting companies. Eight of these projects are concerned with new mining technology and two with processing technology.

The Mining Industry

Mineral Production

The estimated value of mineral production, including metals, industrial minerals and fuels, for the 1985 calendar year was $833.0 million compared to $816.8 million for 1984, an increase of 2.0% (See Tables 5 and 6 in Statistical Supplement).

At $545.6 million (up 1.0%), metals accounted for 65.5% of the total value of Manitoba's 1985 mineral production. The values of the more significant metals produced during 1985 were: nickel $266.6 million (down 3.1%); copper $134.0 million (up 16.8%); zinc $80.4 million (up 16.9%); gold $29.2 million (down 9.6%); silver $9.7 million (down 21.4%).

Mining and Processing Operations

Metallic Minerals

Mining operations in Manitoba are located in the Flin Flon-Snow Lake area, the Lynn Lake-Leaf Rapids area, and at Thompson and Bernic Lake (see Map 1).

Hudson Bay Mining and Smelting Co., Limited operates a number of mines in the Flin Flon-Snow Lake area, concentrators at Flin Flon and Snow Lake, and smelting (copper) and refining (zinc and cadmium) facilities at Flin Flon. Besides treating ores from the company's own mines, Manitoba concentrates from the *Fox* and *Ruttan* mines of Sherritt Gordon Mines Limited and the Trout Lake Joint Venture were also processed at Flin Flon during 1985. The principal products from Hudson Bay's Manitoba facilities are anode copper, refined zinc, refined cadmium and lead concentrate. At the end of 1985, approximately 1 680 people were employed at the company's mines and processing facilities in Manitoba (An additional 375 people were employed at company operations on the Saskatchewan side of the border).

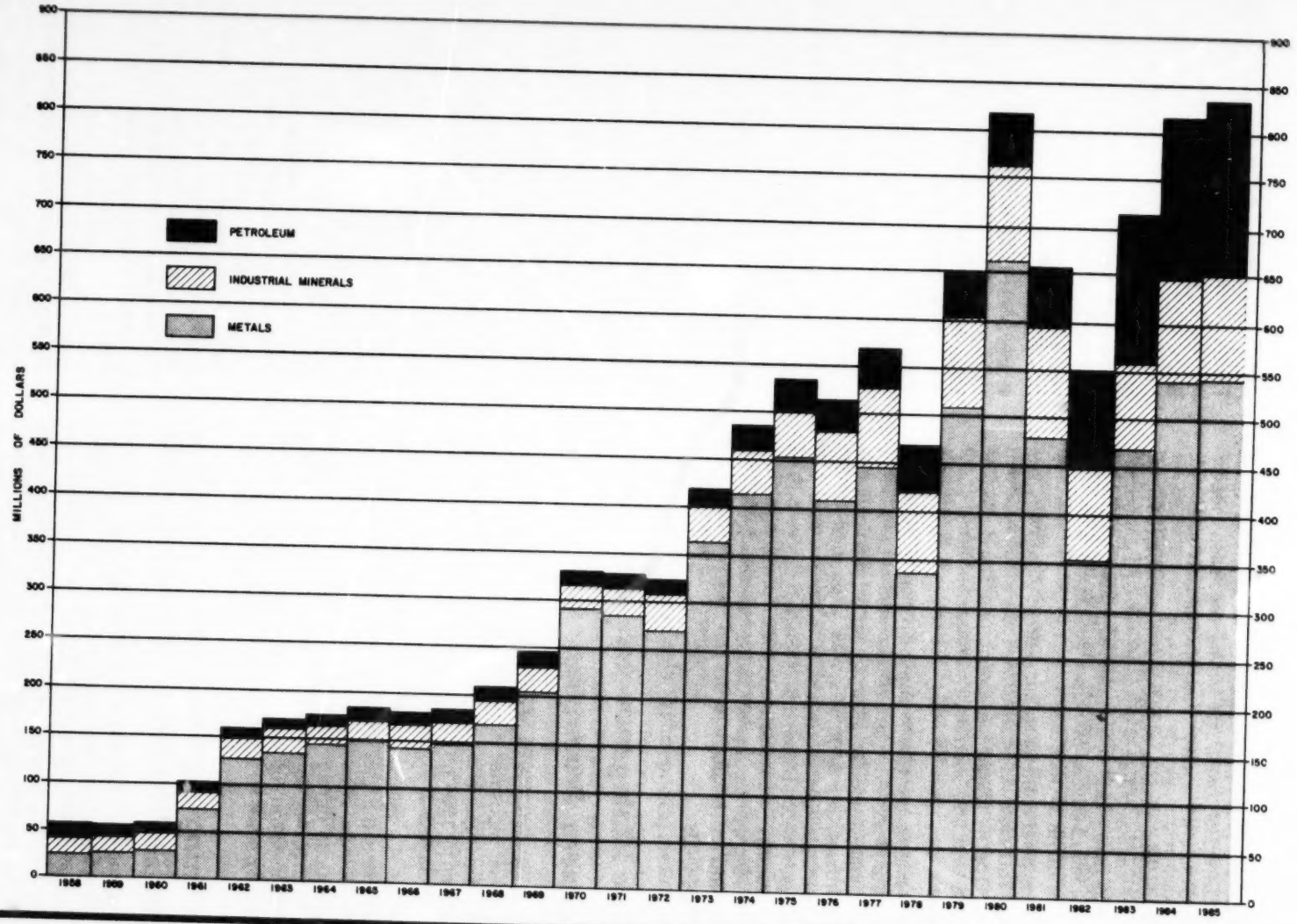
In the Snow Lake area, the company operates five mines. The 3 447 tonne per day concentrator at Stall Lake, inaugurated in June 1979, produces copper and zinc concentrates which are shipped to Flin Flon for further processing, and a lead concentrate which is shipped to Trail, B.C. The *Chisel Lake, Ghost Lake, Stall Lake, Anderson Lake, Spruce Point* and *Rod* mines operated continuously.

In the Flin Flon area, mining operations were maintained at the *Centennial* and *Flin Flon* mines, and the *Trout Lake Mine,* operated under a joint venture agreement (Hudson Bay Mining and Smelting Co., Limited 44%, Scandanavian Minerals Syndicate 29%, and Manitoba Mineral Resources Ltd. 27%). During 1985 production was suspended at the *Westarm Mine* in order to undertake a development program.

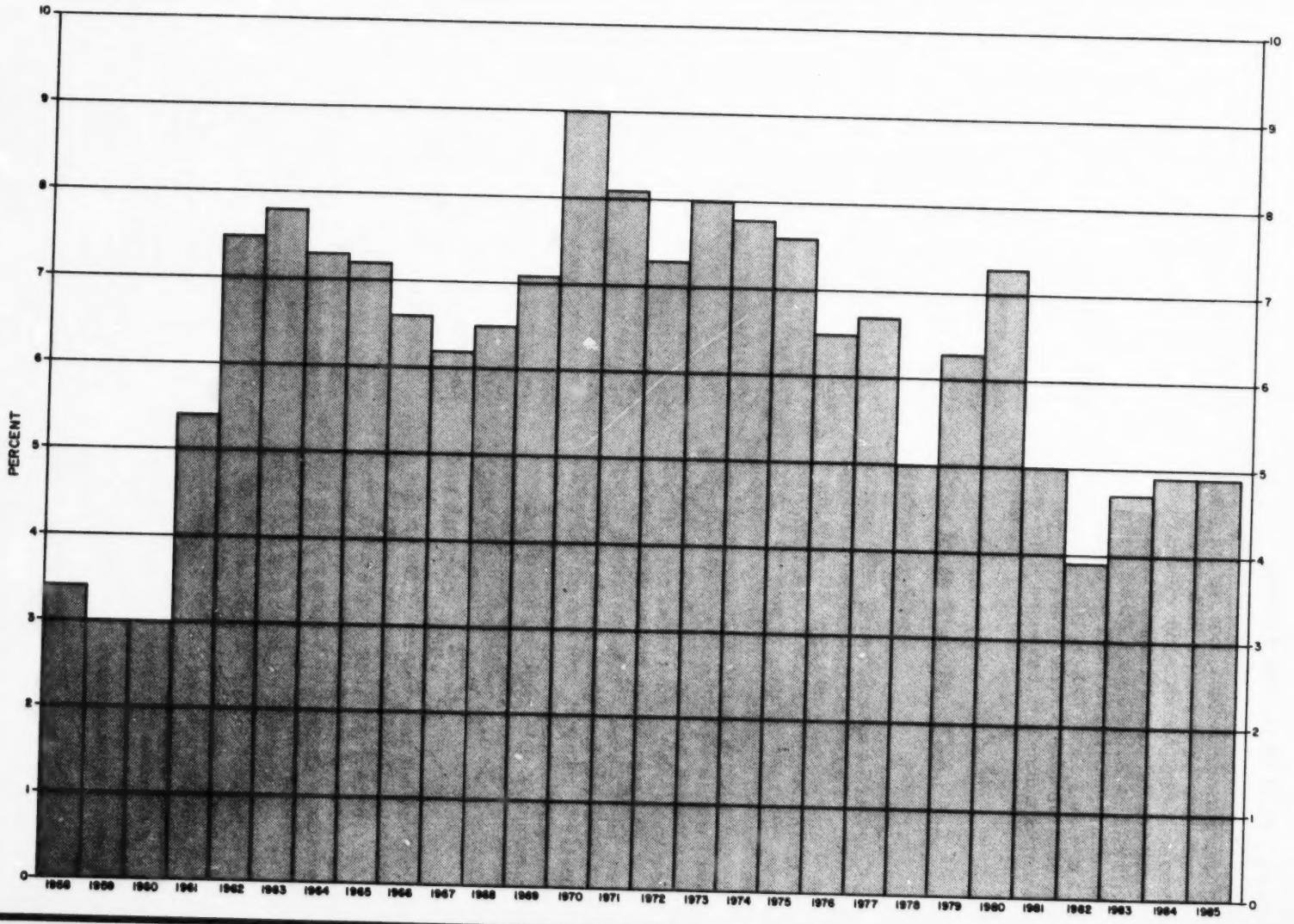
During the year *Inco Limited* operated the Thompson underground mine, a concentrator, smelter and nickel refinery at Thompson. The *Birchtree Mine* continued to be maintained on a standby basis. In 1985, Inco continued development of the *Thompson Open Pit,* a two phase project designed to recover the crown pillar of the Thompson orebody. The Thompson open pit replaces the Pipe open pit which ceased production in the fall of 1984. Dredging which resumed in 1983 continued through 1985. By the end of 1985 pre-production ore was being removed at a rate of 910 tonnes per day. Production at the Thompson Open Pit is scheduled to increase to 3000 tonnes per day by the end of 1986. The main product from the Thompson complex is electrolytic nickel. By-products include copper matte, cobalt oxide and pentlandite concentrate. Copper matte is shipped to the company's refinery at Copper Cliff, Ontario, while commercial grade cobalt oxide is shipped to the company's refinery at Clydach, Wales, where refined cobalt oxides and salts are produced. Pentlandite concentrates are sold as feed for Sherritt Gordon's nickel refinery at Fort Saskatchewan, Alberta.

During 1985, Inco's smelting and refining operations at Thompson continued to receive and process nickel concentrates from the company's mine at Shebandowan, Ontario. Shebandowan feed is processed at Thompson as a result of investment in facilities connected with full scale smelting tests conducted at Thompson in 1981 and 1982.

Gross Value of Manitoba's Mineral Production 1958-85

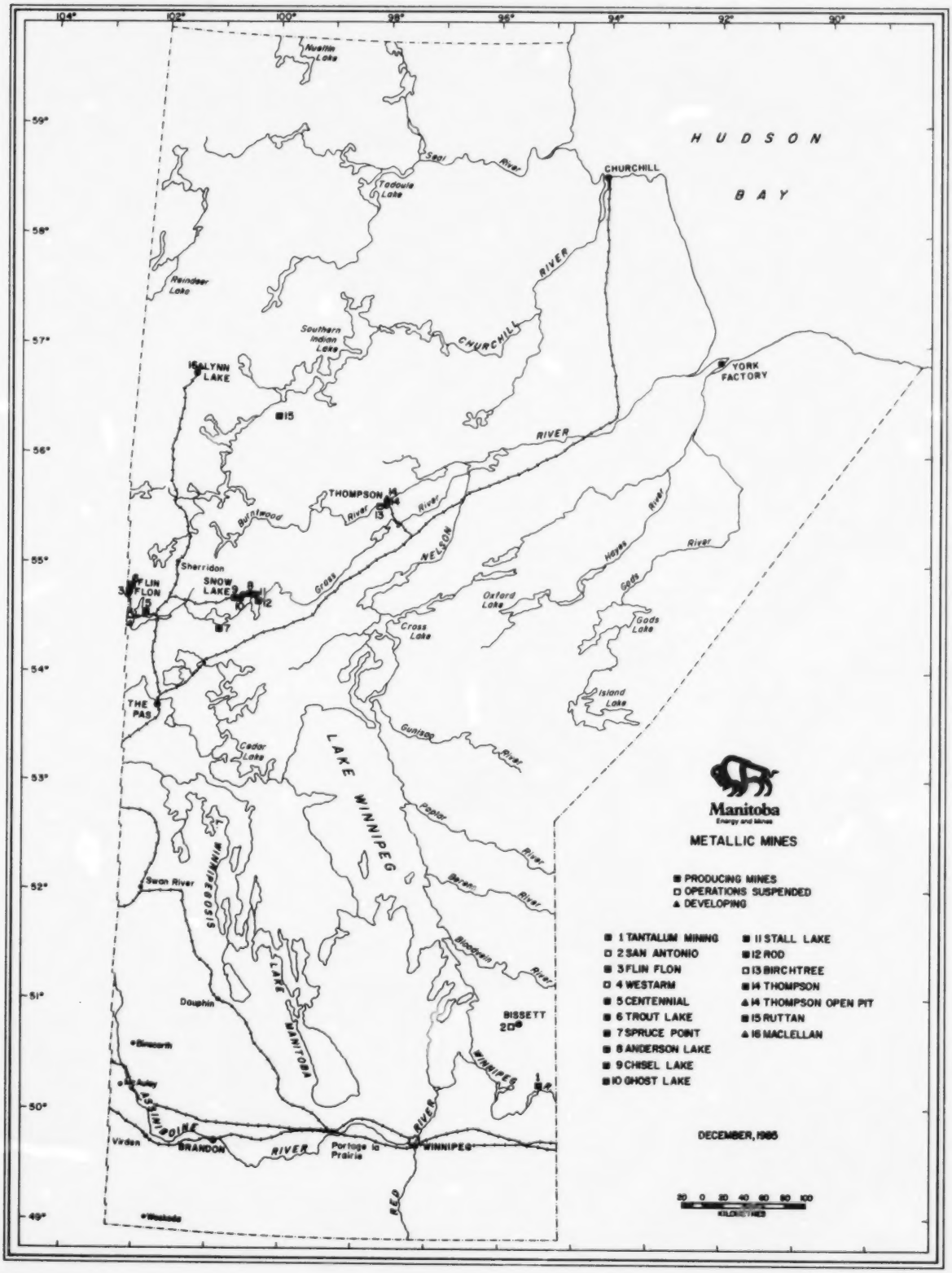


Manitoba's Mineral Production as a Percentage of the Gross Provincial Product 1958-1985



Map 2:

Location of Metallic Mines



An average of 1 925 persons were employed at Inco's Manitoba operations during 1985.

Sherritt Gordon Mines Limited operated two mines and concentrators in the Lynn Lake-Leaf Rapids area during 1985.

Production at the *Fox Mine*, located 48 km southeast of Lynn Lake, ceased at the end of November 1985 as mineable ore reserves were exhausted. Initial production at the *Fox Mine* commenced in 1970. Mining was from blast-hole stopes with an adaptation of this method for pillar recovery. The *Fox Mine* concentrator produced copper and zinc concentrates which were trucked to load-out facilities at Lynn Lake for rail shipment to Flin Flon for further processing.

The *Ruttan Mine*, located 96 km southeast of Lynn Lake, commenced production in 1973 from an open pit. In 1974, development of the underground mine was initiated with a decline and conveyorway. The decline was extended to the 1400 level and a service shaft sunk to the 1000 level. In 1980 this shaft was extended to the 2230 level to permit detailed subsurface drilling of the downward extension of the orebodies.

Further deepening of the shaft to the 3000 level was started in August 1983 and was essentially completed by early 1984. The deepening of the shaft permitted Sherritt to carry out a deep drilling exploration program below the 2600 level, in addition to allowing for development and mining of the Ruttan orebody between the 1400 and 2600 levels. In March 1984, Sherritt's Board of Directors authorized a $28 million development program between the 1900 and 2600 level. Financing of this project was aided by a $10 million loan from the Manitoba Government. Completion of this project has allowed Sherritt Gordon to increase production and employment levels and reduce production costs.

Copper and zinc concentrates produced at the Ruttan mill are trucked to Lynn Lake for rail shipment to Flin Flon, where both zinc and copper concentrates are treated, and Noranda's operations in Quebec where some of the copper concentrates are processed.

At the end of 1985, Sherritt Gordon had 750 employees on the payroll at its Manitoba operations.

Tantalum Mining Corporation of Canada Limited (TANCO)

Tantalum mining operations at Tanco's *Bernic Lake* mine remained suspended during 1985 as accumulated inventories of tantalum concentrates continued to "overhang" the market. Some of the stockpiled concentrate at Bernic Lake was sold in 1985 and further shipments are anticipated in 1986.

In 1984 Tanco, with financial assistance from the Federal Government and by modifying the existing tantalum mill, established a pilot plant to produce a high quality, low iron, spodumene concentrate which can be used directly in the manufacture of such items as ceramic cookware and similar competitive end products. As a result of favourable tests, sales have been made to plants in the US, France and Japan. In anticipation of long term contracts, Tanco is building a new spodumene processing plant at Bernic Lake at a cost of approximately $6.4 million. At the end of 1985, 35 persons were employed at Tanco's Bernic Lake operations.

Precious Metals

MacLellan Mine

In June 1985, Sherritt Gordon's Board of Directors authorized the placing of the *MacLellan gold mine* into production. The MacLellan mine (formerly known as the Agassiz deposit) is located 8 km north east of Lynn Lake. A decision to bring the MacLellan mine into production will soften the impact of the closure of the Fox Mine by providing alternative employment for the majority of the Fox mine employees and will help sustain the community of Lynn Lake, albeit at a reduced level. The MacLellan mine is being developed and operated by SherrGold Inc., which is 60% owned by Sherritt Gordon and 40% publically owned. Under an agreement between Sherritt and SherrGold, Sherritt will manage the operation of the mine. The MacLellan mine is scheduled to be in full production by the end of 1986 at a planned annual rate of 65,000 ounces of gold and 100,000 ounces of silver.

San Antonio

In August 1980, *Brinco Mining Ltd.* and *New Forty-Four Mines Limited* signed a joint venture agreement to reactivate the San Antonio gold mine in Bissett. The former operation, which initially began production in 1932, had been dormant since 1968 when a fire destroyed the hoistroom. The mine is developed by a shaft and three winzes to a total depth of 1 518 metres.

In 1982, the original joint-venture arrangement between Brinco and New Forty-Four Mines Ltd. was renegotiated. Under the new arrangements, Brinco's interest in the mine was increased from 50% to 100% with New Forty-Four Mines Ltd. retaining a 10% net profits interest, payable after Brinco had recovered its costs associated with development and operation of the mine.

The mine was operated during 1982 and until May 1983 when production was suspended. In June 1983, an exploratory drilling program was carried out by Brinco following which all operations were terminated.

In January 1984, *Lathwell Resources Ltd.* concluded an agreement with Brinco for the exploration and

development of the mine, whereby Lathwell could earn a working interest in the assets of the mine. However, Lathwell failed to meet the requirement of the agreement of having to spend a specified amount during the first year and thus lost its option rights to the property.

In November 1985, *Canadian Nickel Company Limited,* a subsidiary of Inco Limited, began the first phase of an exploration and evaluation program to earn an equity position in the San Antonio Mine.

Whiteshell Resources Ltd. completed exploration and feasibility studies on its properties near Star Lake in the Whiteshell Park. A detailed development program was submitted for review by the Parks Branch of the Department of Natural Resources. A work permit was issued in February 1984 for a mining operation in the park with ore to be trucked to a milling site outside the park boundaries. Financing arrangements are being pursued.

Industrial Minerals/Structural Materials

The production and value of industrial minerals and structural materials for 1985 are given in Table 5 in the Statistical Supplement.

A large face-brick plant at Lockport, near Winnipeg, is operated by Red River Brick and Tile Co., using stoneware *clay* from the Ste. Rose du Lac area, *shale* from the Pembina Mountain area, and *sand* from local sources. The plant supplies bricks for the mid-Canada and central-northern United States markets.

Non-swelling bentonite, used mainly in clarification of petroleum and vegetable oils, is mined by Pembina Mountain Clays Inc. near Morden and shipped to the company's plant in Winnipeg for treatment with sulphuric acid to increase its absorbency. Pembina Mountain is the only producer of non-swelling bentonite in Canada.

Gypsum is produced by Domtar Construction Materials Ltd. at Gypsumville for use in the company's wallboard plant in Winnipeg. Westroc Industries Ltd. also produces gypsum at Harcus, near Amaranth for its wallboard plants in Winnipeg and Saskatoon.

Portland Cement production comes from the plant of Genstar Cement Limited at Fort Whyte, using local clay and silica sand and limestone quarried at Steep Rock. In addition, portland cement is produced at the Canada Cement LaFarge Ltd. plant at Fort Whyte using clinker imported from Alberta. Limestone is also quarried north of Mafeking by Genstar, to supply the company's cement plant at Regina.

Steel Brothers Canada Ltd. produces *lime* from kilns in Winnipeg and Faulkner. *Limestone and dolomite* are quarried at Garson by Gillis Quarries Ltd. for *building stone,* and crushed rock is produced by numerous operators in the Interlake region and elsewhere. Cold Spring Granite (Canada) Limited and Whitemouth Granite and Stoneworks operate *granite* quarries in the Lac du Bonnet area primarily for use as building stone. High quality *silica sand* quarried from Black Island in Lake Winnipeg by Selkirk Silica Division of Marine Transport Limited, is exported for use in glass-making, as foundry sand for sand blasting, and as a filtering medium.

Peat moss is produced from sphagnum bogs in southeastern Manitoba and used in horticulture. Fisons Western Corporation operates four bogs near Moss Spur, Julius and Elma. A fifth bog near Giroux was brought into production in the spring of 1983 by Premier West Peat Moss Ltd. Both companies produce a "value-added" product, combining fertilizer with the peat moss.

In 1984, Canamax Resources Inc. and the Province signed a Letter of Intent to undertake joint and separate feasibility studies on *potash* deposits in the Russell-Binscarth area. Feasibility studies undertaken have included establishing project capital and operating costs, assessing available and potential potash markets and selecting preferred mining and processing technologies.

Canamax estimates that the mineable ore reserves grade over 25% K_2O and that current reserves are sufficient for at least 30 years at an annual production rate of 2 million tonnes of product.

Mineral Exploration

Expenditures on mineral exploration in Manitoba for 1985 are estimated at $31.3 million, an increase of 2% from the estimated $30.8 million in 1984. The 1983 figure was an estimated $16.6 million. Diamond drilling on surface exploration was approximatelv 153 716 metres compared to 118 408 metres in 1984, an increase of 30%.

The total area of claims recorded in the province during 1985 decreased 32% to 136 736 hectares from 201 058 hectares in 1984. The 1983 figure was 173 055 hectares. Mineral dispositions (which include claims, permits and leases) in good standing at the end of the year totalled 1 332 159 hectares compared with 1 226 525 hectares at the end of 1984 (an increase of 8%) and 1 000 526 hectares at the end of 1983. The many dispositions acquired in 1984 were consolidated and explored in 1985. The number of individual exploration projects reported during 1985 increased to 203 from 127 in 1984.

A renewed interest in the gold potential of Manitoba's "greenstone" belts was a major factor in the current increase in exploration activity. Along with gold, base metals dominated the exploration scene in and around the greenstone belts of Lynn Lake, Flin Flon-Snow Lake, Island Lake, Gods Lake and Southeastern Manitoba. There was also minor exploration activity for nickel and pegmatite minerals.

Base Metals

In the *Flin Flon-Snow Lake Belt,* exploration activities included geological, geophysical and diamond drilling programs. Companies active in this area were Hudson Bay Exploration and Development Company Limited, Granges Exploration Ltd., Falconbridge Limited, BP-Selco Exploration Ltd., Cominco Ltd., Manitoba Mineral Resources Ltd., and a few junior companies and local prospectors.

Three new base metal prospects in the Belt which show considerable promise are the Consolidated Callinan Mines Ltd. — Hudson Bay copper-zinc deposit, just one mile north of Flin Flon, the newly discovered nickel-copper deposit of Hudson Bay Mining at Namew Lake, south of Flin Flon and the Morgan Lake zinc-copper discovery of Granges, southwest of Snow Lake.

In the *Lynn Lake Belt,* exploration for base metals included geology, geophysics, geochemistry and diamond drilling. Active companies were Sherritt Gordon Mines Limited and Manitoba Mineral Resources Ltd. Drilling programs were conducted by both Sherritt and Manitoba Mineral Resources.

Base metal exploration projects which consisted of geology, geochemistry, geophysics and in several cases diamond drilling were undertaken in the more remote belts of *northern* and *central eastern* Manitoba by Noranda Exploration Company Limited, W.B. Dunlop Ltd. and Hudson Bay Exploration and Development Company Limited. Along the 'Thompson Nickel Belt' Inco Limited conducted geological and geophysical work on several properties.

Gold

The greenstone belts of Manitoba are host to a number of past gold producers which, during 1985, were the prime focus of exploration interest.

The *Rice Lake Belt* and surrounding areas of *Southeastern Manitoba* were quite active for gold exploration, with many companies and prospectors participating. Canadian Nickel Limited (Inco) initiated an underground mapping, sampling and diamond drilling program at the San Antonio mine. A pilot mill project was continued by Reco Gold Mining Limited at the Packsack prospect. Whiteshell Ventures Ltd. initiated a program of surface and underground exploration and development on the Sunbeam-Waverly property near Falcon Lake. Companies involved in various geological, geophysical and diamond drilling programs included Kangeld Resources Ltd., Whiteshell Ventures, Canadian Nickel Company Limited, Esso Resources Limited, Manitoba Mineral Resources, Falconbridge Limited, Noranda Exploration, Tulso Resources Ltd. and other junior companies and local prospectors.

In the *Lynn Lake Belt* Manitoba Mineral Resources, in joint venture with Hudson Bay Exploration, announced in October 1985 the discovery of gold mineralization between Gordon Lake and Farley Lake, located 24 miles east of Lynn Lake. The discovery hole included an 84.9 foot section grading 0.19 oz/ton Au. Further drilling is planned for this coming winter.

In addition to the MacLellan mine development, Sherritt Gordon Mines Limited conducted geochemical, geophysical, and geological work as well as diamond drilling in the Lynn Lake area. During 1985, Manitoba Mineral Resources Limited continued a program, which included prospecting, geology, geochemistry and diamond drilling. South of Lynn Lake, Homestake Mineral Development Company diamond drilled targets in the Beaucage Lake area and Granges Exploration drill tested targets at Gemmell Lake.

During 1985 the gold potential of the *Central Eastern Greenstone Belts* attracted a number of companies including Noranda Exploration at Oxford Lake, Midway Lake Minerals Limited at Island Lake, Westmin Resources Limited in the Utik and Kistigan Lakes area as well as a number of junior companies and prospectors. Most of the work completed consisted of geology, geophysics, geochemistry and some diamond drilling.

Three gold projects in the Flin Flon-Snow Lake Belt have generated considerable excitement and exploration activity; Granges Exploration Ltd.'s (in joint venture with Aberford Resources) Tartan Lake gold project, Hudson Bay's Goldfields option property near Snow Lake and Maverick Mountain Resources — Homestake Mineral Development Company's Puffy Lake project. Diamond drilling on all three of these programs will continue into 1986.

Other companies active for gold in this belt were Noranda Exploration, BP-Selco Exploration Limited, Kidd Creek Mines Ltd. and Dome Exploration (Canada) Limited, as well as several junior companies and local prospectors.

Petroleum

The Petroleum Branch administers provisions under The Mines Act, The Pipe Line Act and The Gas Storage and Allocation Act relating to exploration, development, production and transportation of crude oil and natural gas. The Branch also assists the Department of Finance in administering The Oil and Natural Gas Tax Act.

One of the major functions of the Branch is to develop, recommend, and administer policies and legislative changes to encourage exploration and development of the province's crude oil and natural gas resources in an orderly, safe and efficient manner. The Branch also conducts studies and provides technical assistance to The Oil and Natural Gas Conservation Board on matters relating to salt water disposal, enhanced recovery projects, unitization agreements, and other Board responsibilities.

Collection and analysis of petroleum industry statistics, as well as the monitoring of federal-provincial policies, enables the Branch to evaluate the effects of these policies on the province's petroleum industry.

The Branch releases several reports each year providing the public, industry and government with information on the petroleum industry in Manitoba.

The Branch is comprised of three Sections: Administration, Geology and Engineering and Inspection. Each Section has specific responsibilities relating to the overall function of the Branch.

Administration

The Administration Section administers regulations under The Mines Act governing the disposition of Crown oil and natural gas rights and the collection of Crown oil and natural gas royalties. These responsibilities include: conducting Crown lease and exploration reservation sales; collecting annual rentals; processing renewal and extension applications; and enforcement of other provisions under The Crown Petroleum Leasing Regulations, 1984 and The Crown Petroleum Royalty Regulations, 1984.

The Section also administers the Manitoba Drilling Incentive Program and accumulates and publishes monthly production and disposal/injection data on all active wells in the Province.

The Section administered Manitoba's oil price supplement programs, namely the New Oil Reference Price (NORP) and Special Old Oil Price (SOOP) until its termination on June 1, 1985. Funding for these programs was provided by the federal government. NORP and SOOP supplements were distributed on a monthly basis to Manitoba producers.

The oil export charge revenue-sharing program, also terminated on June 1, 1985, allowed for the 50/50 sharing with the Federal Government of tax on oil exports attributable to Manitoba. The Section was responsible for calculating Manitoba's share of joint Manitoba/Saskatchewan oil streams for use in distribution of export tax revenue.

The Section also assists the Department of Finance in the collection of taxes from producing freehold mineral rights under The Oil and Natural Gas Tax Act.

In addition to internal administrative functions, the Section handles all financial functions of the Branch, including the collection of registration, license and subscription fees and technical service charges.

Geology

The Geology Section evaluates geological data and provides consultation to the petroleum industry and the public. It is responsible for the administration of The Geophysical Regulations and assists The Oil and Natural Gas Conservation Board in the designation of field and pool boundaries.

Another important function of the section is to prepare reports on Manitoba's petroleum geology and hydrocarbon potential to encourage and assist in the exploration and development of the province's petroleum resource.

Engineering and Inspection

The Engineering component, located in Winnipeg, administers regulations under The Mines Act relating to petroleum exploration, drilling and production operations (The Petroleum Drilling and Production Regulations, 1984). As part of this responsibility, it processes drilling license applications as well as applications to recomplete, suspend or abandon wells. Technical support is provided to The Oil and Natural Gas Conservation Board in processing applications relating to well spacing, off-target drilling, production allowables, salt water disposal, pressure maintenance, gas conservation, and unitization.

Through its technical studies of oil and gas reserves, enhanced recovery potential, and the hydrocarbon potential of Manitoba, the Engineering component offers consultation services and information to the petroleum industry and the public.

Administration of The Pipe Line Act and The Gas Storage and Allocation Act are also the responsibility of the Engineering component. In performing its duties,

the component encourages the recovery of Manitoba's petroleum resources while minimizing environmental impact.

The Inspection compo ent of the Section, with district offices in Virden and Waskada, enforces regulations under The Mines Act relating to geophysical, drilling, production and pipe line operations. Staff license and inspect field facilities, investigate complaints, witness specific operations and interpret and communicate departmental or regulatory requirements to industry personnel.

The Inspection component also evaluates various techniques for reclaiming soil contaminated by oil or salt water spills.

The Petroleum Industry

Crown Oil and Natural Gas Lease Sales

Two Crown oil and natural gas lease sales were held in 1985. One hundred and seventy-three leases covering 15 471 hectares were sold for a total of $4,262,410.

In the first lease sale, held on May 8, 1985, the average bonus price paid per hectare was $226.69, whereas in the October 23, 1985 sale, the average bonus price increased by 52% to $344.91 per hectare, a new provincial record.

The highest price in the May sale was $1,280.92 per hectare for two 64 hectare parcels in the Daly area. The highest price in the October sale was a record setting $1,593.78 per hectare for two 64 hectare parcels also located in the Daly area approximately 15 km southwest of Elkhorn.

No exploration reservations were sold in 1985.

Since Crown oil and gas lease sales resumed in 1979, the Province has received $13,287,323 in revenue from the disposition of Crown oil leases and exploration reservations.

Crown Oil and Natural Gas Leases

As of December 31, 1985, the total area of Crown oil and natural gas rights under disposition was 71 473 hectares. Of this total, 70 449 hectares were held under lease and 1 024 hectares under exploration reservations.

On December 31, 1982, deeper rights renewal provisions came into effect for pre-1979 leases. Under these provisions, non-productive areas and rights below the producing formation revert to the Crown at the end of the lease term. Up to December 31, 1985, these regulatory termination provisions resulted in 9 886 hectares being terminated. The cancelled rights again become available for leasing by other parties interested in actively developing them. A lease may be extended for further periods of one year each if a rental penalty is paid and a commitment to a drilling program is made. In 1985, ten leases were extended.

Revenue to Freehold Mineral Owners

More than 80% of the mineral rights in southwestern Manitoba are privately owned (freehold), and it is estimated that gross royalties payable to these owners on oil production in 1985 were approximately $19.8 million (before payment of provincial and federal taxes). In addition there are initial signing bonuses and delay rental payments for new and non-producing leases.

Geophysical Activity

Twenty-five geophysical licenses were issued in 1985. Programs licensed covered approximately 1 745 kilometres, making 1985 another very active year for geophysical exploration activity in the Province. The cost of these programs was in excess of $2 million.

In 1985, geophysical programs were carried out in the following areas of the province: Daly, East Tilston, Whitewater, Hartney, Oak Lake, Kirkella, Pierson, Virden, Souris, Plum Lake, Deloraine, McAuley, Sinclair, Routledge, Reston, Harmsworth, Maples, Hargrave, Russell, Antler, Pipestone, Melita and Elgin.

Table 10 indicates those programs licensed in 1985 by licensee and by geophysical operator.

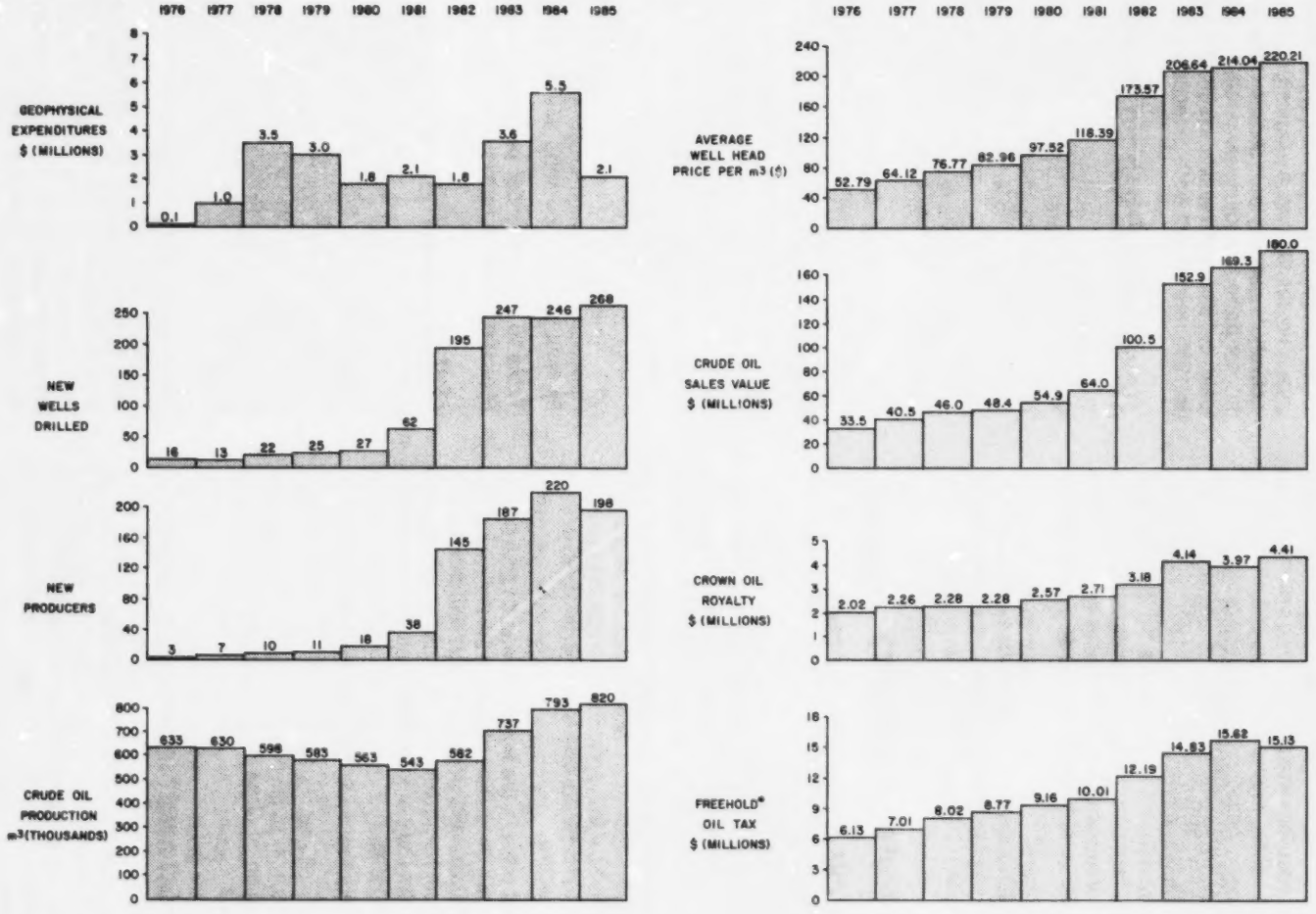
Drilling Activity

In 1985, 313 drilling licences were issued (26% higher than 1984) which resulted in 28 different companies drilling 268 wells (9% higher than 1984). Nine drilling contractors with 17 drilling rigs drilled 231 682 metres of hole. Not since 1955 when 354 wells were drilled has drilling activity been as high. Of the 268 wells completed in 1985, 209 were classified as development wells, while the remaining 59 were exploratory.

The success rate of wells drilled was also very high. Eighty-five percent (229 wells) of the 268 wells drilled were completed as potential oil wells. Three oil companies accounted for 54% of all wells drilled; Omega Hydrocarbons Ltd. (58 wells or 22%), New Scope Resources Limited (54 wells or 20%) and Rideau Petroleums Ltd. (33 wells or 12%).

For the first time since the early 1980s Waskada boom, another oil producing area has come into the limelight. The Daly area last year saw 120 wells drilled (45% of total drilling) while the Waskada area (now in its fifth year of development) recorded 78 wells (29% of total drilling activity). The Virden and Pierson areas accounted for a total of 38 wells.

Performance of the Petroleum Sector 1976-1985



* APPROXIMATELY 60% OF OIL PRODUCTION IS FROM FREEHOLD MINERAL RIGHTS

Three of the 268 wells were drilled below Mississippian Formations, two into the Devonian Formation and one to the Precambrian Formation. All three wells were dry and abandoned.

In September, 1985 Newscope Resources Ltd. and Opinac Energy Limited completed a 905 metre well just north of the Daly Field near Kola, Manitoba. The well was completed in the Bakken Formation making it the first Bakken oil producing well in the province. The Bakken Formation is also the deepest producing formation discovered to date in Manitoba. The total number of producing formations in Manitoba has now increased to four as a result of this significant oil discovery.

For the first time since 1974 drilling was carried out in Hudson Bay. Two wells were drilled in the central Bay area during the summer of 1985. Both wells were part of two separate exploration agreements held by two separate consortia.

The first well, Trillium Soquip Onexco et al Beluga 0-23, was spudded on behalf of the Trillium consortium on July 28th. After reaching a depth of 2 215 metres the well was abandoned as a dry hole.

The second well, ICG Sogepet et al Netsiq N-01, drilled on behalf of the ICG consortium, went to 1 040 metres before also being abandoned as a dry hole on October 20th.

The drilling program was operated by Canterra Energy Ltd. using the dynamically positioned drillship, the Neddrill II.

Both wells are estimated to have cost the two consortia approximately $40 million. For the time being, further exploration work in the Bay has been put on hold.

Seven stratigraphic test holes were drilled by the Northern Michigan Energy Company in the St. Lazare area last spring. The tests were drilled to delineate the extent of recently discovered heavy oil deposits. As of December 31, 1985, no further drilling has been done in the area.

The drilling and exploration activity away from Waskada indicates that interest from the successful Waskada oil play is spreading to other areas of the province.

Table 11 indicates drilling activity during 1985 by operator and by drilling contractor.

Production

Annual oil production in Manitoba reached 820 702 m^3 (5.2 million barrels) in 1985, representing a 4% increase over 1984 and a 12% increase over 1983 production. For the fourth consecutive year since 1968, oil production has increased.

Oil production has been declining at approximately 3.5% per year from 1969 to 1981. The increased oil output since 1982 can be attributed mainly to the continuing development of the Waskada Field and successful exploration and development in the Daly area.

Production from the Waskada Field increased from 85 666 m^3 (540,000 million barrels) in 1982, to 269 284 m^3 (1.7 million barrels) in 1985. As of December, 1985, the average daily production from this Field was approximately 740 m^3 (4,656 barrels).

Production from the Daly area has also increased significantly. In 1984 the Daly area produced 88 782 m^3 (558,700 barrels), while in 1985 production increased to 129 472 m^3 (814,677 barrels) for a 46% increase. The reason for the increase is due mainly to the 98% drilling success rate in the area.

In contrast, production from the Virden Field declined 5.5% from 356 897 m^3 (2.2 million barrels) in 1984 to 337 257 m^3 (2.1 million barrels) in 1985. This reduction reflects declining reserves not supplemented by additional development.

In 1985, 434 972 m^3 (53% of total production) was classified as "New" oil and of this total, approximately 62% was produced from the Waskada Field.

In December 1985 approximately 47% (385 730 m^3) of the oil production in Manitoba was classified as "Old" oil whereas in 1984 "Old" oil accounted for 53% of total production. This decline in "Old" oil production is expected to continue as more new oil is brought into production.

Table 12 indicates 1985 production by operator and by Field.

Oil Prices

The price of "New" oil (D2S3 quality block) in January, 1985 was $255.64/$m^3$ ($40.63 per barrel). "New" oil prices narrowly fluctuated throughout the first five months of 1985 reaching a high of $262.03/$m^3$ ($41.64 per barrel) in April. Compared with 1984, "Old" oil prices remained virtually unchanged. On January 1st, 1985, the selling price of "Old" oil (D3S4 quality block) was $185.09/$m^3$ ($29.42 per barrel) compared with $185.11/$m^3$ ($29.43 per barrel) in January 1984.

Effective June 1, 1985, oil prices across Canada were deregulated under the Western Accord and the administered pricing structure for crude oil was replaced by a one price system dictated strictly by market forces.

For the first time in over a decade, Canadian oil producers, traders, refiners and consumers are able to buy and sell as the market dictates, without restriction on price or volumes and without obtaining government approvals, subsidies, licenses or permits.

In July 1985, the average price of crude oil (new and old oil combined) increased to $233.48/m^3 from May's average price of $221.38/m^3. Throughout the second half of 1985, prices remained in the $220.00 - 240.00/m^3 range.

The average price of crude for December was pegged at $228.90/m^3 range.

Value of Production

The total value of oil production during 1985 was $180.0 million, a 6% increase over 1984 production and an 18% increase over 1983. The main reasons for the increase were the increased production levels and slightly higher average oil prices as a result of deregulation.

Provincial Revenue from Oil Production

For the fourth consecutive year Provincial Government revenues from petroleum activity increased due to higher production levels, excellent lease sale results and more wells ending their royalty and production incentive periods. The Manitoba Government collected approximately $24.1 million in revenues ($4.4 million in Crown oil royalties, $15.1 million in freehold oil taxes and $4.6 million in Crown lease sale bonuses, rentals and fees), resulting in a 7% increase over 1984. These figures do not include provincial revenues in the form of corporate capital tax, sales tax, municipal tax and corporate and individual income tax.

Municipal Tax Assessments

Oil producers in Manitoba pay a municipal tax on wells and associated production facilities, including: oil wells, batteries, salt water disposal wells, salt water disposal plants, water injection wells, suspended wells, flowlines and pipelines.

The municipal tax assessment on these facilities for the period from September 1984 to September 1985 was approximately $8.60 million dollars, an increase of 31% over the previous year.

Actual revenue from these assessments should amount to approximately $2.15 million for affected municipalities.

Surface Owners

Companies wishing to explore or develop oil properties in Manitoba must negotiate a surface lease with the individual landowner. In return for this right-of-entry, the landowner normally receives a negotiated cash settlement which includes a first-year bonus payment and subsequent annual rental payments for the duration of the lease.

Where the landowner is renting his land to another party, the oil company seeking right-of-entry must obtain the consent of both the landowner and the occupant. After a lease has been signed, the landowner and occupant then determine what each will receive as their respective share of the compensation paid by the oil company.

Following proclamation of The Surface Rights Act on August 9, 1983, disputes relating to right-of-entry are referred to the Surface Rights Board. The Board's principal function is to arbitrate disputes between the petroleum industry and landowners regarding use of land for exploration, development and related operations and to determine what compensation should be paid to the landowner.

In September, 1985, jurisdiction of the Surface Rights Board was transferred to the Department of Municipal Affairs from the Department of Energy and Mines. The Board's office was relocated to Winnipeg from Virden.

In 1985, an estimated $4.0 million was paid by oil companies to landowners in the form of first-year bonuses ($1.5 million) and annual rental fees ($2.5 million).

The Board publishes its own annual report.

Oil Price Supplement Programs

Since inception in January, 1982 a total of $66.2 million has been paid to Manitoba producers under the NORP and SOOP supplement programs.

New Oil Reference Price (NORP) Program:

The NORP program became effective on January 1, 1982, and carried through until June 1, 1985 when it was eliminated as a result of the Western Energy Accord. As New Oil production levels continued to increase, the total value of NORP supplements also increased for the first five months of 1985.

The NORP program worked in the following manner: Operators that produced "conventional new oil" sold their production at "old" oil prices to purchasers and later received a NORP supplement funded by the Government of Canada. The NORP supplement, together with the price for "old" oil, made the amount

received for NORP production equal to the world oil price.

The Petroleum Branch of the Manitoba Department of Energy and Mines administered the NORP program in Manitoba.

As of May 31, 1985, 584 wells were eligible for NORP supplements. For the five months of the program in 1985, NORP supplements valued at $11.9 million were paid out.

Special Old Oil Price (SOOP) Program:

The SOOP program also continued to operate until June 1, 1985 after which it, too, was eliminated. As of May 31, 1985, production from the 25 qualifying SOOP wells received a total of $201,190 in supplements.

Manitoba Drilling Incentive Program

The "Manitoba Drilling Incentive Program" provides for reduced Crown oil royalty and freehold oil tax rates on oil produced from new wells. Wells drilled between January 1, 1979 and January 1, 1987, and producing from Crown mineral rights may qualify for a special reduced royalty incentive rate which is 35% of the corresponding base royalty rate charged on "Old" oil. New wells producing from freehold mineral rights are eligible for a corresponding incentive tax rate under The Oil and Natural Gas Tax Act.

The reduced royalty and tax rates apply to production from a new oil well during its respective incentive period. The incentive period earned for wells producing from provincial Crown mineral rights is called the "royalty incentive period" (RIP) whereas wells producing from freehold mineral rights earn a "production incentive period" (PIP).

As of December 31, 1985 approximately 41% of the 1,505 wells capable of producing oil in the province were operating under an incentive period (17% under RIP and 83% under PIP). Fifty-eight per cent of the 617 incentive wells in the province are located in the Waskada area while 24% are located in the Daly area.

It is estimated that since the program was implemented in 1979, the value of the incentive to industry has been in excess of $12.1 million.

Waskada Gas Plant

During 1985 the Waskada gas plant, now in its second year of production, operated at approximately 50% of capacity (capacity = 85 000 m^3/day). The plant, which was built to extract propane, butane and condensate, produced approximately 12 m^3 of propane, 3 m^3 of butane and 8 m^3 of condensate daily.

In 1985, 7 304.3 m^3 of propane, butane and condensate were produced valued at $1,034,382. Compared with 1984, volumes in 1985 increased by 149%. Of the total 7 304.3 m^3 produced, propane accounted for 56%, butane 19% and condensate 25%.

As of December 31, 1985, the dry processed gas from the plant was being flared while underground injection and storage were being studied.

Petroleum Industry Employment

The petroleum industry in Manitoba, although small in comparison to Alberta and Saskatchewan, continued to record respectable gains by virtue of the fact that new hydrocarbon deposits were discovered and developed. With the proliferation of activity in the last few years, drilling activity, production, crude oil sales and revenues increased.

Naturally this increased activity has resulted in an increase in direct industry employment. In 1980, for example, it was estimated that the petroleum industry generated approximately 50 person years of employment. In 1985 that number increased substantially to 335 person years of employment (a 570% increase).

In addition to direct employment generated by industry activity, there were many indirect jobs created as a result of the petroleum industry multiplier effect. For every direct job created by the petroleum industry in 1985, there were another 1.1 jobs that were indirectly supporting the industry. This resulted in another 375 person years of indirect employment compared with only 55 person years in 1980.

Industry Expenditure

As a result of the very active oil patch activity in Manitoba during 1985, it is estimated that industry spent close to $139 million in the province or 77% of the total value of oil produced during the year.

The total expenditures can be broken down into seven categories: exploration, development, land, producing facilities, producing costs, royalties and other.

The exploration component, which includes exploratory drilling costs, geophysical and geological work amounted to approximately $15.8 million.

Development costs include development drilling costs which accounted for approximately $36.0 million.

Land costs were based on freehold and Crown mineral and surface rights acquisition costs, fees and rentals. The total estimated cost of this component amounted to $10.3 million.

Producing facilities included mainly capital costs associated with field equipment and enhanced recovery schemes. Approximately $9.0 million was spent on this component.

Production costs were valued at $25.4 million and include well operation, flow line and gas plant costs.

Royalties include Crown production royalties, freehold oil taxes and freehold mineral rights royalties. It was estimated that this component was valued at $38.8 million for 1985.

Other costs in total industry expenditure include municipal taxes, right-of-way acquisitions and miscellaneous expenditures totalling approximately $3.2 million.

Oil Reserves

From 1973 to 1980, remaining established oil reserves in Manitoba declined at a rate of approximately 5% per year due to production and lack of new discoveries.

This trend began reversing in 1980 as new discoveries were made in the Kirkella area. New discoveries in the Waskada area in 1981 further arrested the decline and as a result of additional development in the area in 1982 and 1983, reserves increased. This increase in the province's remaining established reserves followed more than 16 years of decline.

As of December 31, 1985, the province's total remaining established crude oil reserves were estimated to be 8.83 million m^3 (56 million barrels) up sharply by 10.1% from 1984. The additional increase can be attributed mainly to successful exploration and development in and around the Daly Field during 1984 and 1985.

Oil and Natural Gas Conservation Board

The Oil and Natural Gas Conservation Board is established under provisions of The Mines Act with powers to inquire into all matters relating to the drilling, production, transportation, and distribution of oil and natural gas in Manitoba. The Board conducts hearings and may make orders as specified under The Mines Act.

The Board also processed applications and issued the following Orders:

- Board Order No. 75A pertaining to maximum permissible rate of production in the Waskada Lower Amaranth Unit No. 1, the Waskada Unit No. 2, the Waskada Unit No. 3, the Waskada Unit No. 4, the Waskada Unit No. 5 and the Waskada Unit No. 8.
- Board Order No. PM 44 authorizing a waterflood pressure maintenance project into the Waskada Lower Amaranth A Pool.
- Board Order No. Pm 45 authorizing a waterflood pressure maintenance project into the Waskada Lower Amaranth A Pool.
- Board Order No. P4-85 designating and delineating underground reservoirs within the province to be known as Pools.
- Board Order No. F3-85 designating areas within the province to be known as Fields.
- Board Order No. 14 SWD authorizing the disposal of produced salt water into the well Chevron Whitewater SWD A11-16-3-21 WPM.
- Board Order No. 15 SWD authorizing the disposal of produced salt water into the well New Scope et al Coulter SWD A7-21-1-27 WPM.
- Board Order No. 16 SWD authorizing the disposal of produced salt water into the well Chevron Whitewater 13-16-3-21 WPM.
- Board Order No. 17 SWD authorizing the disposal of produced salt water into the well Andex et al Waskada SWD 9-26-1-26 WPM.
- Board Order No. 18 SWD authorizing the disposal of produced salt water into the well Saskoil Virden SWD B15-3-11-26 WPM.
- Board Order No. 19 SWD authorizing the disposal of produced salt water into the well Resman Jorex et al Daly SWD 1C-35-9-28 WPM.

Policy Planning and Project Development

Energy Policy

Energy Policy provides research and analytical services to the departmental executive, the Energy Management Branch and the Manitoba Energy Authority. It also advises the Government on emerging energy issues having implications for the province.

Energy Policy develops and recommends positions relative to provincial and extra-provincial energy matters and recommends energy development strategies for policy consideration. It maintains comprehensive information on the current and future energy market within the province and in other jurisdictions, as required.

Energy Policy assesses specific energy-related and resource development projects. Economic and financial analysis of hydro-electric development, potential electricity exports, energy conservation projects, and energy-intensive industries including aluminum smelting was undertaken during the fiscal year. Much of the work was done in support of the Manitoba Energy Authority.

Energy Policy intervenes in hearings and deliberations of extra-provincial regulatory and advisory bodies such as the National Energy Board as required.

Energy consumption in the province in the years 1983 to 1985 is given in Tables 14 and 15.

Mineral Policy

The function of this Section is to undertake analysis and evaluation of the economic and policy impact of provincial, national and international mineral developments on the provincial mineral industry, and to assist in policy development and implementation. Studies conducted by the Section contribute to effective management of the provincial mineral resources and the maintenance of appropriate and effective mineral and mineral tax policies.

The Section is also responsible for the collection and analysis of provincial mining statistics. This function is carried out both by direct provincial surveys of mine and mill production, and through agreements with the federal Department of Energy, Mines and Resources and Statistics Canada, by undertaking on behalf of these agencies surveys of Manitoba mining and exploration companies. A survey of exploration companies active in the province is conducted by the Section in December of each year to provide an estimate of exploration expenditures in the current year and a forecast for the forthcoming year.

Revenue from mining and quarrying collected under the provisions of The Mines Act, The Mining Royalty and Tax Act, and The Mining Tax Act for the fiscal year 1984/85 was $10,764,650 compared with $35,829,952 for the previous year (see Table 2).

The Section is responsible for activities under Sector C of the Canada/Manitoba Mineral Development Agreement, Development and Marketing Studies. Studies have focussed on the viability of Manitoba's copper-zinc sector and development opportunities for the province's industrial minerals.

Staff of the Section undertook and participated in various studies pertaining to the cyclical and structural difficulties facing Manitoba's mining industry and single industry communities, such as Lynn Lake, Leaf Rapids, Flin Flon and Snow Lake and co-chaired the joint Energy, Mines and Resources Canada/Manitoba Energy and Mines study "New Financial Mechanisms for Addressing Mining Community Problems".

Staff also participated in feasibility and taxation studies and market development activities aimed at the development of potash mining and processing in the Russell-Binscarth area of southwestern Manitoba.

The Director of Mineral Policy chaired the interdepartmental committee which reviewed the impact of Sherritt Gordon's Fox mine on the community of Lynn Lake and worked with the community and the company to put Lynn Lake back on a fairly secure footing. The Section also participated in federal/provincial/industry discussions on mining taxation issues.

Financial and Administrative Services

The Financial and Administrative Services Branch provides a broad spectrum of service functions in support of the activities of the entire Department. These support services are mainly in the areas of Finance, Personnel, Operations and Information Systems. The Branch is also responsible for administrative policy development.

In 1985/86, similar services were provided by the Branch to the Manitoba Energy Authority, the Limestone Training and Employment Agency and the Manitoba Jobs Fund-Limestone Development Office.

Financial Services

Financial Services provides a wide range of financial, accounting and budget services to the Department. These include:

- financial planning and estimates preparation
- financial advice to program directors and managers
- expenditure control
- financial reporting
- voucher processing
- disbursement accounting
- revenue accounting
- Treasury Board and Cabinet submission co-ordination

Significant accomplishments in the past year included continuing changes in the Estimates process to provide more input from the political and executive bureaucratic levels to improve the department's planning process. In addition, Financial Services has initiated activity to computerize its financial planning, and periodic forecasts of expenditures and revenues.

Personnel, Payroll and Operations

Personnel, Payroll and Operations provides centralized human resource and operational support services to the Department. These services include:

- position classification
- recruitment and selection
- employee relations
- training and development
- organizational analysis
- salary, benefits and payroll administration
- affirmative action co-ordination
- performance appraisal management
- co-ordination of requests for departmental goods and services
- records management

In 1985-86, a total of 16 positions were reviewed and reclassified, while 35 positions were staffed at all levels throughout the Department.

A Departmental reorganization and senior management review was completed by the end of the 1985 fiscal year. This resulted in a more cohesive clustering of programs and a broadening of senior management accountability.

Other accomplishments for the year included the establishment and approval of a Departmental Affirmative Action plan and the development of a more co-operative approach to management through several team building sessions.

Information Systems

Information Systems provides the Department with data processing, word processing and library support services. The services provided include:

Data Processing

- equipment evaluation, acquisition and users' education
- computer systems design and implementation
- policy and standards development
- liaison between Department and other government agencies

Word Processing

- maintenance and backup of the main word processing equipment
- assistance to divisions with word processing needs
- policy and standards development

Library

- purchasing services for journals and books
- cataloguing of books and government documents
- reference and inter-library loans to Department employees, industry and education institutions.

The major accomplishments of the past year included the establishment of the Computer Information Centre with state of the art equipment and software, total decentralization of word processing and acquisition of personal computers for use by the Energy Management Branch in the delivery of programs.

Communications and Community Relations Branch

The role of the Communications and Community Relations Branch is fourfold:

— to inform the public about the Department's activities;
— to assist other Branches in their communications tasks;
— to provide communications services to government agencies reporting to the Minister of Energy and Mines; and
— to inform all Department staff of the activities of other Branches through internal communication.

Public Information

In its public information role, the Branch maintains a high profile on a day-to-day basis with its Energy and Mines Info Centre in Eaton Place. This storefront information office stocks a wide selection of provincial and federal publications and publications from Manitoba Hydro. Examples of publications distributed by the Info Centre are:

— energy management techniques for homes, businesses, and community organizations and institutions;
— Manitoba's energy resources, including hydroelectricity, oil, and natural gas;
— government energy conservation loan programs.

The Info Centre answers public inquiries received by mail and telephone as well as from visitors to the Centre. Between April 1, 1985 and March 31, 1986, the Centre handled 13,868 inquiries. The Centre also does extensive mailings of many Energy and Mines publications. Communications staff prepared an informational brochure explaining the function of the Info Centre to the general public during the 1985-86 fiscal year.

The community relations role of the Branch involves outreach activities throughout the province. Staff set up over forty multi-media displays over the year on various topics, combining audio-visual productions with distribution of Departmental publications. Displays were set up at fairs, shopping malls, schools, and community group meetings in Winnipeg and in communities such as Brandon, Portage la Prairie, Thompson, Winkler, Morris, Selkirk, Dauphin, Swan River, Flin Flon, The Pas, Morden, Altona, and Carmen. Community Relations staff produced five slide shows, two displays (one Departmental and one related to the Limestone Generating Station), and a Limestone model display. Approximately 135,000 pieces of Limestone-related informational literature were distributed at Community Relations displays, and about 15,000 pieces related to the Home CHEC-Up and CHEC Loan programs. An additional 80,000 pieces of literature related to Home CHEC-Up and 80,000 related to CHEC Loan were mailed to Manitoba homeowners in the 1985-86 fiscal year.

The Branch conducts media relations in conjunction with the central Information Services, issuing news releases and arranging news conferences on the Department's activities. In 1985-86, the Branch prepared 29 news releases.

The public information role of the Branch also involves promoting Departmental programs, particularly in the areas of energy conservation and management. Staff developed a communications strategy, wrote copy, and supervised the production and implementation of promotional materials, including four brochures, a booklet, and print and radio ads, for programs such as Home CHEC-Up, CHEC Loan, the Manitoba Energy Audit Program, and Community and Business CHEC. Communications staff also helped arrange an open house and news conference marking the official opening of the Dakota Plains Reserve greenhouse project in June 1985. In addition, staff prepared an assortment of brochures and pamphlets to inform the public about other Departmental activities and programs. These included the Manitoba Potash Project, the Dakota Plains Greenhouse, and the first annual Manitoba Energy Conservation Week from February 24 to March 1, 1986.

The Branch prepared and published three issues of a new periodical entitled *The Limestone Bulletin,* with a *Northern Supplement* insert for northern mailings. Other Limestone-related Branch activities included an audio-visual presentation, which was shown at the 1985 Red River Exhibition in Winnipeg and throughout the province thereafter, reprints of five brochures, and the creation and publication of one new brochure.

The Branch carried out the information transfer component of the now-expired federal-provincial Conservation and Renewable Energy Demonstration Agreement and the subsequent federal-provincial interim agreement. The Branch produced nineteen reports and two manuals on energy conservation projects, as well as popular summary sheets on these projects. Staff also assisted in the preparation of a series of six booklets showing homeowners how to retrofit for energy conservation. This series is slated for publication during the 1986-87 fiscal year.

Support for Other Branches

Communications and Community Relations supported other Branches in their communications tasks in numerous ways. Staff published a pamphlet explaining the services offered by the Mineral Exploration Services Branch, prepared a display for the Petroleum Branch, arranged for signage at the province's Precambrian Drill Core Library facilities, published the Petroleum Branch's Oil Activity Review, published a Geological Map of Manitoba for the Geological Services Branch, and helped in arranging Geological Services' 1985 Annual Meeting With Industry.

The Branch aided the Department's minerals and mining-related Branches by reprinting six publications in the Mineral Education Series. Branch staff also aided technical staff in revising the manuscripts of three of these booklets and preparing new creative work, as well as preparing new publications in the series. These were extremely well-received by the mining and mineral processing industries and the general public. Staff developed and disseminated information on the Canada-Manitoba Mineral Development Agreement, including three brochures, the first Agreement annual report, assorted materials such as report covers and media kit folders, and an audio-visual presentation, which was shown at the Prospectors and Developers Convention in Toronto in March 1986. Community Relations staff also created a freestanding Mineral Development Agreement display for the annual Meeting With Industry in November 1985.

Support for Reporting Agencies

Agencies reporting to the Minister of Energy and Mines which received Communications and Community Relations' services included the Surface Rights Board of Manitoba, Manitoba Hydro, the Manitoba Energy Authority, the Manitoba Jobs Fund Limestone Development Office, and the Limestone Training and Employment Agency. Branch staff arranged or aided in a variety of public information functions for these agencies. For the Manitoba Energy Authority, the Branch helped to arrange the official start-up of construction of the Limestone Generating Station, as well as a news conference marking the start of a major upgrading at Genstar Cement. Genstar's upgrading is taking place in connection with the Limestone cement supply contract, awarded to Genstar by Manitoba Hydro. The Branch aided in Manitoba Hydro's production of the Northern Business Sourcing Directory for the Limestone hydro-electric project. Staff arranged for the production of the Manitoba Energy Authority's 1984-85 annual report and that of the Surface Rights Board, as well as publishing a series of three booklets for the Manitoba Energy Authority, promoting Manitoba's hydro-electric advantage.

Internal Communication

Communications and Community Relations aided internal communication among all Branches by producing the Departmental newsletter, *Gems and Joules*.

Statistical Supplement 1985/86

Table 1

Energy and Mines Expenditure Summary

Year Ended March 31, 1986

	$ 000's			
			Variance	Explanation
	Actual	Estimate	Inc(Dec)	Number
Administration and Finance				
Minister's Salary	18.1	19.6	(1.5)	
Executive Support	283.2	270.4	12.8	
Communications	169.2	225.9	(56.7)	1
Financial and Administrative Services	517.4	500.6	16.8	
TOTAL	987.9	1,016.5	(28.6)	
Energy				
Policy Planning & Project Development	515.5	576.7	(61.2)	
Provincial Energy Programs	948.9	1,276.6	(327.7)	2
Provincial Audit Programs	369.2	365.7	3.5	
Cut Home Energy Costs (CHEC)*	450.3	626.6	(176.3)	3
Manitoba Energy Council	17.3	35.0	(17.7)	4
Canada/Manitoba ERDA-Hydrogen Study and Aluminum Smelter Transportation Study	143.5	0.0	143.5	5
Jobs in Energy Conservation**				
TOTAL	2,444.7	2,880.6	(435.9)	
Mineral Resources				
Mineral Resources Management	220.2	214.9	5.3	
Petroleum	720.2	687.3	32.9	
Mines	1,499.6	1,549.7	(50.1)	
Geological Services	1,978.9	1,960.6	18.3	
Canada/Manitoba Mineral Development Agreement (MDA)	1,985.2	2,028.9	(43.7)	
Surface Rights Board***	128.9	134.7	(5.8)	
TOTAL	6,533.0	6,576.1	(43.1)	
Expenditures Related to Capital Assets				
Acquisition/Construction of Physical Assets (MDA)	188.1	148.6	39.5	6
Capital Grants (Provincial Energy Programs)	745.4	1,187.5	(442.1)	2
TOTAL	933.5	1,336.1	(402.6)	
TOTAL DEPARTMENT	10,899.1	11,809.3	(910.2)	

* *CHEC Loans totalling $4,500.0 were funded by the Manitoba Jobs Fund.*

** *$2,420.4 for energy conservation programs was provided by the Manitoba Jobs Fund.*

*** *Transferred to the Department of Municipal Affairs effective September, 1985.*

Explanation of Major Variances

1. Major reductions attributable to changes in community outreach practices, publications budgeted for were not prepared in both the Mineral Education Series and energy conservation, and mineral resources general promotion was not undertaken. These decreases were offset by the acquisition of word processing equipment.
2. Major reduction attributable to the lack of new conservation demonstration and development projects undertaken during extended negotiations with Canada on the new "Conservation and Alternative Energy Agreement", to replace the expired Canada-Manitoba Energy Agreement. Expenditures were concentrated on completing projects initiated prior to March 31,1985.
3. Major reduction attributable to lack of CHEC Program advertising and reproduction/reprinting of the CHEC list brochure, lower utility administrative fees and inspection services costs due to lower CHEC loan volume, and lower random and complaint inspections.
4. Major reduction attributable to the Council's engaging consulting assistance only in the area of reviewing/developing a least cost energy framework.
5. Funding is budgeted and provided from the Canada-Manitoba Enabling Vote under the Canada-Manitoba Economic Development Planning Agreement.
6. Major increase reflects adjustments to programming providing for the acquisition of an atomic absorption spectrophotometer and other equipment required to support geological field activities under the Canada-Manitoba Mineral Development Agreement.

Table 2
Revenue from Mining and Quarrying
(to March 31st)

	1984/85	1985/86
Disposition, Fees, Rentals, etc.	$ 917,021	$ 1,369,899*
Mining Claim Lease Tax	76,410	76,723
Royalties (from industrial mineral production)	554,352	551,226
The Mining Royalty and Tax Act**	—	—
The Mining Tax Act***	9,216,867	23,000,000
TOTAL	$10,764,650	$24,997,848

* *Includes rental arrears in the amount of $255,932.44 for mining claim leases grouped under O.I.C. 574/57, 1061/57, 1699/57, 1913/57, 224/59 and 1290/61.*

** *Collection of a royalty under The Mining and Royalty and Tax Act was discontinued after December 31, 1980. The revenue shown represents re-assessments for the period prior to that date.*

*** *The Metallic Minerals Royalty Act was redesignated The Mining Tax Act effective January 1, 1981. Revenue shown includes re-assessments made under the former Act.*

Table 3
Mineral Dispositions in Good Standing
at calendar year end 1982 to 1985

	1982		1983		1984		1985	
Mining	**No.**	**Hectares**	**No.**	**Hectares**	**No.**	**Hectares**	**No.**	**Hectares**
Mining Claims	6,308	690 392	5,783	646 951	6,029	715 303	5,887	702 754
Order in Council Leases	4,184	119 382	4,184	119 382	4,184	119 382	4,184	119 382
Permits	8	281 039	6	193 288	11	351 006	8	279 456
Explored Area Leases	38	14 372	38	14 372	38	14 338*	37	14 050
Production Leases	28	12 665	27	12 649	25	12 612	25	12 612
Miscellaneous Mineral Leases	1	403	1	403	1	403	1	403
Special Permit							1	190 022
Potash								
Permits	1	13 480	1	13 480	1	13 480	1	13 480
Quarrying								
Leases	366	10 594	368	10 602	393	11 472	403	11 676
Exploration Permits	9	815	9	815	6	742	6	693
Limestone Exploration Permits					2	228	2	228
Peat								
Leases	18	3 329	18	3 037	23	3 803	24	3 951
Exploration Permits	9	1 249	4	631	5	1 780	4	841
TOTAL	10,970	1 147 720	10,439	1 015 610	10,718	1 244 549	10,583	1 349 548

**Area of Lease reduced*

Table 4

Mineral Dispositions Issued

each calendar year 1982 to 1985

	1982		1983		1984		1985	
Mining	**No.**	**Hectares**	**No.**	**Hectares**	**No.**	**Hectares**	**No.**	**Hectares**
Mining Claims	643	115 703	891	173 055	1,112	201 058	783	136 736
Permits	5	198 841	3	124 927	8	226 079	3	106 420
Explored Area Leases	—	—	—	—	—	—	—	—
Production Leases	—	—	—	—	—	—	—	—
Miscellaneous Mineral Leases	—	—	—	—	—	—	—	—
Special Permit	—	—	—	—	—	—	1	190 022
Quarrying								
Leases	76	2 042	17	299	34	1 077	23	516
Exploration Permits	1	788	—	—	—	—	1	128
Limestone Exploration Permits	—	—	—	—	2	228	—	—
Casual Permits	78	—	74	—	64	—	74	—
Permissions to Remove	528	—	569	—	508	—	612	—
Peat								
Leases	5	712	3	98	5	766	1	148
Exploration Permits	3	529	—	—	3	1 699	2	760

Table 5

Comparison of Manitoba Mineral Production and Value

1984 and 1985

	1984 (Jan-Dec)			1985 (Jan-Dec)*		
	Quantity (Imperial)	Value ($ 000)	Quantity (Metric)	Quantity (Imperial)	Value ($ 000)	Quantity (Metric)
Metals	(000 lb)		(000 kg)	(000 lb)		(000 kg)
Cadmium	328	720	149	355	586	161
Cobalt	961	12,543	436	780	12,128	354
Copper	148,894	127,781	67 537	149,262	133,986	67 704
Lead	1,801	604	817	1,506	394	683
Nickel	89,677	275,165	40 677	83,560	266,603	37 902
Selenium	157	1,827	71	99	973	45
Tantalum	—	—	—	86	3,045	39
Tellurium	7	88	3	9	100	4
Zinc	107,705	68,737	48 854	139,711	80,356	63 372
Other	—	292	—	—	1,510	—
Precious Metals	(000 tr oz)		(000 g)	(000 tr oz)		(000 g)
Gold	69	32,327	2 154	68	29,231	2 101
Platinum Group	28	8,473	862	22	7,011	672
Silver	1,142	12,365	35 519	1,125	9,724	35 000
TOTAL METALS		540,922			545,647	
Industrial Minerals	(000 ton)		(000 tonne)	(000 ton)		(000 tonne)
Clay Products	—	7,613	—	—	7,650	—
Cement	370	34,192	336	343	33,148	311
Gypsum	191	1,848	173	251	2,605	228
Lime	—	6,194	—	—	5,725	—
Peat Moss	78	9,837	71	93	12,494	84
Quartz	—	3,038	—	—	2,959	—
Sand/Gravel	12,889	31,953	11 693	13,680	33,150	12 410
Stone	2,337	11,927	2 120	2,119	8,635	1 922
TOTAL INDUSTRIAL MINERALS		106,602			106,366	
Fuels	(000 bbl)		(000 m^3)	(000 bbl)		(000 m^3)
Petroleum	4,990	169,296	793	5,191	180,000	825
Natural Gas By-Products				57	950	9
GRAND TOTAL		816,820			832,963	

**Estimated*

Source: Manitoba Energy and Mines

Table 6

A Comparison of Value of Manitoba Metals, Industrial Minerals, Fuels and Total Mineral Production

From 1973-1985
(Calendar Year)

	($000)			
Year	Metals	Industrial Minerals	Fuels	Total
1973	363,650	38,416	17,148	419,214
1974	413,530	45,556	27,169	486,255
1975	452,236	50,662	31,451	534,349
1976	412,301	69,173	33,557	515,031
1977	446,691	81,597	40,428	568,716
1978	338,123	83,696	45,937	467,756
1979	510,049	94,279	48,403	652,731
1980	664,809	100,814	54,968	820,591
1981	478,636	115,189	64,251	658,076
1982	353,150	96,607	101,065	550,822
1983	471,077	87,360	152,892	711,329
1984	540,922	106,602	169,296	816,820
1985*	545,647	106,366	180,950	832,963

**Estimated*

Table 7

Manitoba Petroleum Statistics

(1976-1985)
(Calendar Year)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Geophysical Licenses Issued	3	2	5	10	11	11	19	14	23	25
Geophysical Expenditures ($)	118,308	1,046,220	3,451,370	2,970,734	1,843,438	2,116,854	1,805,512	3,639,692	5,547,086	2,100,000
Drilling Licenses Issued	21	16	27	29	71	201	284	249		313
New Wells Drilled	16	13	22	25	27	62	195	247	246	268
Wells on Production	3	7	10	11	18	38	145	187	220	197
New Wells Abandoned	10	2	6	9	9	15	30	24	30	30
Metres Drilled	13 515	11 584	18 329	20 537	23 508	61 011	184 291	229 304	220 631	231 682
Wells Capable of Production (Dec)	821	804	808	811	823	853	1 002	1 160	1 350	1 505
Wells Producing (December)	688	701	703	705	720	748	869	1 041	1 209	1 366
Abandoned Producers	24	7	3	4	5	5	11	13	30	14
Other Wells Abandoned	3	1	2	1	0	3	8	5	0	1
Crude Oil Production (m^3)	633 322	630 466	598 354	583 377	563 482	542 695	582 283	736 934	793 286	820 702
Water Production (m^3)	4 021 932	4 228 083	4 075 178	3 946 337	4 171 051	4 565 210	4 581 786	5 079 609	5 575 632	5 864 460
Total Fluid Production (m^3)	4 655 254	4 858 549	4 673 532	4 529 714	4 734 533	5 107 905	5 163 997	5 816 543	6 368 916	6 685 162
% Water Cut	86	87	87	87	88	89	89	87	88	88
Avg. Oil Production (m^3 per day)	1 730	1 727	1 639	1 598	1 540	1 487	1 595	2 019	2 173	2 248
Total Oil Value $	33,532,609	40,457,038	45,953,383	48,403,314	54,958,340	64,054,832	100,537,270	152,349,870	169,296,154	180,049,438
Crown Oil Royalty ($ received)	2,023,828	2,263,015	2,281,355	2,280,162	2,574,515	2,714,733	3,175,625	4,135,497	3,972,225	4,412,927
Freehold Oil Tax ($ received)	6,128,261	7,012,188	8,017,968	8,768,511	9,159,426	10,005,107	12,194,350	14,825,318	15,639,045	15,132,581
Average Oil Price per m^3 ($)	52.99	64.14	76.77	82.97	97.57	118.39	173.57	206.64	214.04	220.21
Reservation Sale Bonuses ($)	(last sale held in 1969)		—	40,888	820,345	611,199	—	40,192	—	—
Lease Sale Bonuses ($)	(last sale held in 1971)		—	897,895	1,057,530	1,074,958	1,055,668	1,032,885	2,181,499	4,215,082
Reservation & Lease Rentals & Fees ($)	10,766	10,237	10,198	49,300	133,686	191,409	235,812	274,088	281,673	306,792
Crown Reservation Area (ha)	—	—	—	4 736	16 915	22 291	20 947	14 496	1 024	1 024
Crown Lease Area (ha)	6 954	6 759	6 759	22 559	29 519	40 806	45 752	57 462	66 053	70 449
Total Crown Area Under Disposition (ha)	6 954	6 759	6 759	27 295	46 434	63 097	66 699	71 958	67 077	71 473
Industry Reported Total Expenditures ($)*	14,600,000	18,900,000	27,900,000	31,000,000	38,300,000	55,200,000	82,600,000	116,500,000	121,600,000	138,500,000**

* *Source: Canadian Petroleum Association*

** *Source: Petroleum Branch, Manitoba Energy and Mines*

Table 8

Summary of Crude Oil and Salt Water Production — All Fields

	Oil				Water		
	Cum. Prod. Dec. 31/84 m^3	Production 1985 m^3	Total Cum. Prod. m^3	Wells Producing Dec. 1985	Cum. Prod. Dec. 31/84 m^3	Production 1985 m^3	Total Cum. Prod. m^3
Daly Field	3 655 179.9	129 386.9	3 784 566.8	258	15 729 321.8	1 113 367.4	16 842 689.2
Tilston Field	89 306.4	7 888.0	97 194.4	18	502 758.8	23 274.2	526 033.0
Waskada Field	727 996.4	269 326.4	997 322.8	368	808 630.4	485 117.7	1 293 748.1
Lulu Lake Field	38 885.9	7 021.7	45 907.6	7	169 081.2	7 665.7	176 746.9
Virden Field	17 897 283.1	337 256.5	18 234 539.6	551	67 277 922.2	3 926 567.5	71 204 489.7
Whitewater Field	94 367.2	14 522.8	108 890.0	19	74 708.4	48 614.6	123 323.0
Pierson Field	282 585.1	22 455.8	305 040.9	49	569 905.5	58 622.0	628 527.5
West Butler Field	30 412.8	1 172.8	31 585.6	3	6 531.3	1 370.6	7 901.9
Kirkella Field	206 648.8	9 783.3	216 432.1	34	1 508 939.7	124 949.4	1 633 889.1
Souris Hartney Field	127 797.8	2 421.5	130 219.3	7	235 546.8	13 216.0	248 762.8
Coulter Area	6 786.3	702.6	7 488.9	2	43 151.1	6 052.3	49 203.4
South Pierson Field	17 425.9	5 012.0	22 437.9	10	50 581.1	16 666.8	67 247.9
Other Areas	29 444.9	5 628.4	35 073.3	11	185 571.7	23 168.4	208 740.1
Undesignated Pools	—	—	—	—	6 335.7	—	6 335.7
Confidential Wells	—	8 123.4	8 123.4	29	—	15 807.3	15 807.3
PROVINCIAL TOTAL	23 204 120.5	820 720.1	24 024 822.6	1 366	87 168 985.7	5 864 459.9	93 033 445.6

Table 9

Crude Oil Sales; Transporters' Deliveries

1985

Producers Disposition

Field	Production	Sales (m^3)	Value of Sales
Daly	129 386.9	87 269.2	$ 25,304,003
Tilston	7 888.0	7 879.5	1,610,581
Waskada	269 326.4	268 228.8	56,059,283
Lulu Lake	7 021.7	7 166.4	1 449,704
Virden	337 256.5	342 057.4	70,843,189
Whitewater	14 522.8	17 347.4	3,508,905
Pierson	22 455.8	22 570.3	4,270,908
West Butler	1 172.8	495.6	101,939
Kirkella	9 783.3	9 701.6	1,852,812
Souris Hartney	2 421.5	2 429.5	487,456
Coulter	702.6	309.6	62,638
South Pierson	5 012.0	4 856.1	995,594
Other Areas	5 628.4	10 616.9	1,366,616
Confidential Wells	8 123.4	—	—
TOTAL	820 701.1	817 633.7	$167,913,628

Transporters' Deliveries To:

Province	Location	Refinery	(m^3)
Ontario:	Corunna	Shell	11 102.2
	Corunna	Sunoco	4 251.2
	Sarnia	Imperial	230 010.8
Quebec:	Montreal	Imperial	6 744.3
	Montreal	Petrofina	62 206.6
	Montreal	Shell	328 872.6
	Montreal	Sunoco	45 948.9
	Montreal	Texaco	39 735.4
USA:			
Illinois	Mokena	Union	76 594.0
Minnesota	Clearbrook	Ashland	5 234.7
Minnesota	Clearbrook	Koch	124 822.6
N.Y.	West Seneca	Sunoco	4 680.0

Table 10

Summary of 1985 Petroleum Geophysical Programs

Geophysical License No.	Licensee	Contractor	Km Licensed
240	Suncor	Sonics Exploration Ltd.	48.9
241	Saskoil Resources Ltd.	Curzon Exploration Ltd.	36.5
242	Roxy Petroleum Ltd.	Century Geophysical	37.0
243	Tricentrol Oils Ltd.	Beaver Geophysical	3.4
244	Tundra Oil and Gas	Century Geophysical	12.1
245	Petrel Consultants Ltd.	Pacer Geophysical	36.5
246	Petrel Consultants Ltd.	Pacer Geophysical	25.0
247	Gale Resources Ltd.	Gale Resources Ltd.	251.4
248	Petrel Consultants Ltd.	Pacer Geophysical	7.4
249	Petrel Consultants Ltd.	Pacer Geophysical	11.5
250	Petrel Consultants Ltd.	Pacer Geophysical	2.8
251	Saskoil Resources Inc.	Curzon Exploration Ltd.	27.0
252	PanCanadian Petroleum	Sonics Exploration Ltd.	21.6
253	Newscope Resources Ltd.	Century Geophysical	263.4
254	Voakes Seismic	Voakes Seismic	33.4
255	Shapco Resources Ltd.	Format Resources Corp.	33.0
256	Columbia Gas Development of Canada Ltd.	Sonics Exploration Ltd.	135.0
257	Gale Resources Ltd.	Gale Resources Ltd.	160.0
258	PanCanadian Petroleum Ltd.	Phoenix Geophysics Ltd.	79.1
259	Petro-Canada Inc.	Sonics Exploration Ltd.	220.0
260	Voyager Energy Co.	Sonics Exploration Ltd.	87.3
261	Home Oil Ltd.	Beaver Geophysical	24.9
262	Petrel Consultants Ltd.	Pinnacle Geophysical Ltd.	118.8
263	Andex Oil Co. Ltd.	Curzon Exploration Ltd.	32.0
264	Freeman Energy Ltd.	Sonics Exploration Ltd.	37.0
TOTAL			1 745.0

Table 11

1985 Petroleum Drilling Statistics

No. of Wells Drilled by Operator	1985	1984
Omega Hydrocarbons Ltd.	58	72
Newscope Resources Ltd.	54	26
Rideau Petroleums Ltd.	33	7
Tundra Oil and Gas	17	13
Beaverhead Resources Ltd.	16	16
Andex Oil and Gas Ltd.	15	8
Resman Holdings Ltd.	13	34
Northern Michigan Energy Co.	7	N/A
Roxy Petroleum Ltd.	7	3
Mead Petroleums and Farms Ltd.	6	N/A
Saskoil Resources Inc.	4	2
Voyager Petroleums Ltd.	4	2
Westmin Resources Ltd.	4	N/A
Bonus Petroleum Ltd.	3	N/A
Chevron Canada Resources Ltd.	3	5
Lasmo Exploration (Canada) Ltd.	3	3
Wildmount Resources Ltd.	3	6
Antler River Resources Ltd.	2	1
Contact Ventures Ltd.	2	N/A
Dome Petroleum Ltd.	2	2
Frontier Resources Ltd.	2	N/A
Home Oil Company Ltd.	2	N/A
Peregrine Petroleums Ltd.	2	N/A
Rife Resources Ltd.	2	N/A
Geocrude Energy Inc.	1	N/A
Shapco Resources Ltd.	1	N/A
Texoro Resources Ltd.	1	N/A
Whitewater Oil and Gas Corporation	1	N/A
TOTAL	268	N/A

No. of Wells Drilled by Contractor	1985	1984
Crown Drilling Ltd.	102	73
Red Arrow Drilling Ltd.	87	96
Can Am Drilling Ltd.	52	45
Spartan Drilling Ltd.	17	11
Sedco Drilling Ltd.	4	N/A
Sabre Drilling Ltd.	3	N/A
Badger Drilling Ltd.	1	N/A
Hemsing Drilling Ltd.	1	N/A
J. Horn Drilling	1	N/A
TOTAL	268	N/A

Table 12

1985 Annual Oil Production

By Operator	Vol. (m^3)
Chevron Canada Resources Ltd.	338 792.5
Omega Hydrocarbons Ltd	215 699.4
Newscope Resources Ltd.	40 192.2
Tundra Oil and Gas	25 412.6
Geocrude Energy Inc.	19 823.2
Beaverhead Resources Ltd.	17 429.7
Canadian Roxy Petroleum Ltd.	16 957.9
Andex Oil Co. Ltd.	16 691.5
Rideau Petroleums Ltd	16 324.9
Resman Holdings Ltd.	13 126.9
Resman Oil and Gas Ltd.	11 641.6
Samedan Oil of Canada, Inc.	11 185.9
Mead Petroleums & Farms Ltd.	7 961.8
ICG Resources Ltd.	6 319.1
Canada Northwest Energy Limited	4 905.6
Lyleton Corporation	4 729.2
Wildmount Resources Ltd.	4 548.3
Murphy Oil Company Ltd.	4 222.0
Trans Canada Resources Ltd.	4 138.5
Can-Tex Drilling & Exploration Ltd.	3 593.0
Triton Petroleum Limited	3 419.7
Canadian Reserve Oil & Gas Ltd.	2 778.0
Koch Exploration Canada Inc.	2 478.5
Suncor Inc.	2 428.6
Saskoil Resources Inc.	2 325.5
Texaco Exploration Canada Ltd.	1 605.6
Peregrine Petroleums Ltd.	1 378.3
Dome Petroleum Limited	1 298.1
Scurry Rainbow Oil Limited	1 100.7
John Deroy Gerrand Oil Syndicate	1 021.3
Sasko Oil & Gas Ltd.	1 008.2
Teck Corporation Ltd.	1 000.6
Other	7 039.6
Confidential Wells	8 123.4
TOTAL	820 702.1

By Field	Vol. (m^3)
Virden	337 256.5
Waskada	269 326.4
Daly	129 386.9
Pierson	22 455.8
Whitewater	14 522.8
Kirkella	9 783.3
Tilston	7 888.0
Lulu Lake	7 021.7
South Pierson	5 012.0
Souris Hartney	2 421.5
Coulter	702.6
West Butler	1 172.8
Other Areas	5 628.4
Conf. Wells	8 123.4
TOTAL	820 702.1

Table 13

Publications

Manitoba

	REPORTS
Departmental Publications	
Bedrock Geology Compilation Map 64F	Uhlman Lake — NTS 64B; 1:250 000, with marginal notes — Manitoba Energy and Mines
Geological Report GR84-1	Geochemistry of Metavolcanic Rocks in the Lynn Lake Belt — E.C. Syme
Economic Geology Report ER84-2	Silica in Manitoba — D.M. Watson
Open File Report OF85-3	Preliminary Results of Till Petrographical and Till Geochemical Studies at Farley Lake — E. Nielsen and D.C. Graham
Open File Report OF85-4	Platinum-Palladium Distribution of Ultramafic Rocks in the Bird River Complex, Southeastern Manitoba — P. Theyer
Open File Report OF85-6	The Vegetation Geochemical Signature of the Agassiz-Stratabound Au-Ag Deposit, Lynn Lake, Manitoba — M.A.F. Fedikow
Open File Report OF85-8	Chromite Reserves of the Bird River Sill — D.M. Watson
Open File Report OF85-9	Canada-Manitoba Mineral Development Agreement 1984-89 Sector 'A' Geoscientific Activities, Progress Report 1984-85
Open File Report OF85-11	Mercury Gas Surveys over Base and Precious Metal Mineral Deposits in the Lynn Lake and Snow Lake Areas, Manitoba — M.A.F. Fedikow
Aggregate Report AR 84-1	Surficial Geology and Aggregate Resource Inventory of the Rural Municipality of Whitemouth — R.V. Young
Aggregate Report AR 84-2	Surficial Geology and Aggregate Resources of the Fisher Branch Area : Local Government District of Fisher and Rural Municipality of Bifrost — H.D. Groom
MAP AR 84-3	Quarternary Geology of the Gypsymville Area — by E. Nielsen and G. Matile
Map AR 84-5	Quarternary Geology Map of the Birds Hill Area — by G. Matile
Aggregate Report AR 85-1	Aggregate Resources in the Rural Municipality of Wallace — by P.R. Berk
Aggregate Report AR 85-3	Aggregate Resources in the Rural Municipality of Miniota — by H.D. Groom
Aggregate Report AR 85-4	Surficial Geology and Aggregate Resource Inventory of the Rural Municipality of Shell River — by UMA Engineering Ltd.
Mineral Education Series	Sand and Gravel in Manitoba — compiled by R.V. Young
Internal Resource Management Reports	Aggregate Resources in the Rural Municipality of Russell — compiled by C. Jones
	Aggregate Resources in the Rural Municipality of Wallace — compiled by C. Jones

Departmental Publications Cont'd

Report of Field Activities
(released Nov. 20, 1985; 266 p.)

Summary and introductory review (1985-86 program)
by W.D. McRitchie

LYNN LAKE DISTRICT

GS-1 Lynn Lake regional compilation and geochronology
by H.V. Zwanzig, J.S.D. Parker, D.C.P. Schledewitz and W.R. Van Schmus

GS-2 Rubidium-strontium geochronology in the Churchill and Superior Provinces, northern Manitoba
by G.S. Clark

GS-3 Till sampling along the Agassiz Metallotect
by E. Nielsen, M.A.F. Fedikow and G.G. Conley

GS-4 Till geochemical investigations in northwestern Manitoba
by E. Nielsen

GS-5 Mineral deposit studies in the Lynn Lake and Barrington Lake areas
by D.A. Baldwin, D. Parbery, S. Boden, and A. Michielsen

GS-6 Geology and mineral occurrences in the Nickel Lake area, Agassiz Metallotect
by M.A.F. Fedikow and D.R. Eccles

GS-7 A study of the alteration zone associated with the Lar deposit, Laurie Lake area, Manitoba
by S.R. Elliott and E.C. Appleyard

GS-8 Geological investigations at Cartwright Lake, Manitoba
by David C. Peck

GS-9 Evaluation of industrial mineral occurrences in the Lynn Lake area
by W.R. Gunter and P.H. Yamada

FLIN FLON DISTRICT

GS-10 Athapapuskow Lake Project
by Eric C. Syme

GS-11 Geological investigations in the Chisel Lake-Reed Lake area
by Alan H. Bailes

GS-12 Kisseynew Project
by H.V. Zwanzig

GS-13 Kisseynew Project: Kississing Lake, Big Island-Yakushavich Island region
by D.C.P. Schledewitz

GS-14 Kisseynew Project: Geological reconnaissance of Kisseynew Lake West
by W.D. McRitchie

GS-15 Investigation of mineral occurrences in the Kisseynew meta-sedimentary terrain
by S. Peloquin, G. Ostry and G.H. Gale

GS-16 Geology of the Tartan Lake area
by S. Peloquin and G.H. Gale

GS-17 Geological Setting of the Baker Patton and Centennial Mine sulphide deposits
by D. Hayden-Luck and G.H. Gale

GS-18 Vamp Lake, geology and mineralization
by P. Laznicka and R.S. Wadein

GS-19 Mineral deposit studies in the North Star Lake area
by G. Ostry

GS-20 Mineral occurrence documentation and alteration zone mapping, Snow Lake area
by D.R. Eccles and M.A.F. Fedikow

Departmental Publications Cont'd

GS-21 Evaluation of industrial mineral occurrences in the Snow Lake area
by W.R. Gunter and P.H. Yamada

GS-22 Project Cormorant — sub-Paleozoic investigations south of Flin Flon and Snow Lake
by W.D. McRitchie and I. Hosain

SOUTHEAST MANITOBA DISTRICT

GS-23 Geological investigations in the Stormy Lake area
by D.M. Seneshen and D.J. Owens

GS-24 U-Pb zircon geochronology of the Rice Lake area
by A. Turek, W. Weber and W.R. Van Schmus

GS-25 Cat Creek Project
by J.J. Macek

GS-26 Sub-Quaternary Precambrian investigations in the Whitemouth Lake area
by W. Weber

GS-27 Mineral deposit investigations in the Rice Lake greenstone belt
by P. Theyer

GS-28 Mineral occurrence documentation in the Rice Lake greenstone belt
by P.W. Stewart

GS-29 Mineral deposit investigations in the Wallace Lake-Siderock Lake area
by R.G. Gaba

GS-30 Fluid inclusion studies — San Antonio mine
by D.F. Strong and G.H. Gale

GS-31 Evaluation of dimension stone potential of granite rocks in southeastern Manitoba
by B.E. Leathers

THOMPSON-CROSS LAKE DISTRICT

GS-32 Cross Lake supracrustal investigations in the eastern Pipestone Lake area
by M.T. Corkery

GS-33 Pipestone Lake intrusive complex: geological and geophysical investigations
by H.D.M. Cameron

GS-34 Northeastern Cross Lake Project
by J.J. Macek

GS-35 Geological investigations in the Phillips Lake area
by J.J. Macek

GS-36 U-Pb geochronology program: Thompson belt and Pikwitonei domain
by T. Krogh, L. Heaman, N. Machado Fernandez, and W. Weber

GS-37 Evaluation of industrial mineral occurrences in the Thompson area
by W.R. Gunter and P.H. Yamada

ISLAND LAKE-GODS LAKE DISTRICT

GS-38 Geological investigations in the Island Lake-Stevenson Lake area
by H.P. Gilbert

GS-39 Geological investigations in the Knight Lake-Bigstone Lake area
by K.L. Neale

GS-40 Granite-pegmatite investigations: Knee Lake-Magill Lake area
by P.G. Lenton

GS-41 Pegmatitic granites, pegmatites and other felsic plutonic rocks at Gods Lake and Red Cross Lake, Manitoba
by L.E. Chackowsky, X. Wang, R. Eby, and P. Cerny

Departmental Publications Cont'd

MANITOBA-GENERAL

GS-42 Limestone River compilation
by W.D. McRitchie

GS-43 Stratigraphic mapping and stratigraphic and industrial minerals core hole program
by H.R. McCabe

GS-44 Industrial Minerals of the Swan Lake area
by D.M. Watson

GS-45 Industrial Mineral investigations: Southern Manitoba
by D.M. Watson and W.R. Gunter

GS-46 Stratigraphy and age of landslides along the Porcupine Hills
by E. Nielsen

GS-47 Lead-zinc potential in Paleozoic rocks of southern Manitoba
by E. Nielsen and G.H. Gale

EXPLORATION SERVICES SECTION

ES-1* Manitoba's Precambrian drill core collection program
by J.K. Filo and P.J. Doyle

ES-2 Compilation, Promotion and Exploration Services (MDA Project 5.9)
by J.D. Bamburak

*Funding in part through the MDA

AGGREGATE RESOURCES

AR-1 Aggregate Resources in the Rural Municipality of South Norfolk
by R.V. Young

AR-2 Aggregate Resources in the Rural Municipality of Shellmouth
by R.V. Young

AR-3 Aggregate Resources in the Rural Municipality of Roblin
by P.R. Berk

AR-4 Aggregate Resources in the Local Government District of Reynolds
by G.L.D. Matile

AR-5 Aggregate Resources management in Manitoba
by C.W. Jones

Preliminary Maps 1985
(released Nov. 20, 1985)

1985 B-1 Knight Lake-Wass Lake (53E/11NW) 1:20 000
by K.L. Neale

1985 C-1 Cat Creek (52L/12) 1:10 000
by J.J. Macek

1985 I-1 Wakun Lake (53E/13NE) 1:20 000
by H.P. Gilbert

1985 I-2 Ogit Lake (53E/13NW) 1:20 000
by H.P. Gilbert

1985 I-3 Loonfoot Island (53E/16SE) 1:20 000
by H.P. Gilbert (Revised 1984 I-1)

1985 I-4 Meegeesiwaseeson Island (53E/16SW) 1:20 000
by H.P. Gilbert

1985 I-5 Wagner Island (63H/16NE) 1:20 000
by H.P. Gilbert

Departmental Publications Cont'd

1985 K-1 Kisseynew Lake West: Weasel Bay area (63K/13NW) 1:20 000
by W.D. McRitchie

1985 K-2 Big Island-Yakushavich Island, Kississing Lake (63N/3)
by D.C.P. Schledewitz

1985 N-1 Cross Lake, Northeast (parts of 63I/II, 14) 1:50 000
by J.J. Macek, G. Finnson and G. Liebrecht (Revised 1984 N-1)

1985 N-2 Pipestone Lake (parts of 63I/5 and 63I/12) 1:20 000
by M.T. Corkery and H.D.M. Cameron

1985 N-3 Pipestone Lake, south shore (detailed) (part of 63I/12SE) 1:100
by H.D.M. Cameron

1985 R-1 Stormy Lake (part of 52L/14SW) 1:10 000
by D.J. Owens and D.M. Seneshen

1985 T-1 Phillips Lake (part of 63-0/1, 8) 1:20 000
by J.J. Macek

1985 MI-1 Geology of the Tartan Lake area (part of 63K/13) 1:5000
by S. Peloquin

1985 MI-2 Geology of the Evans Lake (Kay Lake) area (part of 63N/2) 1:5000
by S. Peloquin and D. Hayden-Luck

1985 SM Aggregate Resources in the Rural Municipality of Shellmouth (parts 62N-3, 4 and 62K-13, 14) 1:50 000
by H. Groom

1985-R-OB Aggregate Resources in the Rural Municipality of Roblin (62G-3, part 62G-6) 1:50 000
by P. Berk

1985 SN Aggregate Resources in the Rural Municipality of South Norfolk (parts 62G-9, 10, 15 and 16) 1:50 000
by R.V. Young

Oral Presentations

February 1986 Resource Management and Subdivision Review Process R.M. of Daly Municipal Council, Rivers, Manitoba
by C. Jones

II UNPUBLISHED REPORTS

(on file in Manitoba Energy and Mines, Geological Services Branch)

Anderson, D.T.
1986: Integrated geological, geochemical and remote sensing study of the host rocks of the Agassiz gold deposit, Lynn Lake, Manitoba; Applied Geoscience Research Agreement, University of Manitoba, 4 p.

Appleyard, E.C. and Elliot, S.R.
1986: Lithogeochemistry and metasomatic flux of the alteration zone associated with the Lar deposit, Lynn Lake area, Manitoba: A progress report; Applied Geoscience Research Agreement, University of Waterloo; 25 p.

Cerny, P.
1986: Rare-element-enriched pegmatite evaluation project: Summary report, April 1/85-March 31/1986; 20 p.

Gaba, R.G.
1986: Geology of the Archean turbidite-hosted Gatlan gold occurrence, Wallace Lake greenstone belt, southeast Manitoba: Progress Report; Applied Geoscience Research Agreement, University of Western Ontario, 96 p.

Gunter, R.
1986: Industrial Minerals of Manitoba.

Unpublished Reports Cont'd

Heaman, L., Machado, N. and Krogh, T.
1986: Report on U-Pb dating of the northwestern region of the Superior Province and the Thompson belt in Manitoba.

Krogh, T., Heaman, L. and Machado, N.
1986: Summary of Manitoba U-Pb geochronology projects.

Taylor, W.D.
1985: A study of zircon morphology and previous isotope age determinations from rocks of the Rice Lake greenstone belt, southeastern Manitoba; B.Sc. thesis, University of Windsor.

Turek, A.
1985: Preliminary U-Pb zircon ages from rocks of the Rice Lake greenstone belt.

Turek, A. and Van Schmus, W.R.
1986: Zircon geochronology — Rice Lake greenstone belt, Manitoba.

Turek, A., Weber, W., Van Schmus, W.R.
1985: Zircon geochronology of the Rice Lake area: A progress report (basis for Manitoba Geological Services Branch Report of Field Activities, 1985; GS-24).

Weber, W.
1985: Preliminary interpretation of U-Pb ages from the northern Superior Province.

iii EXTERNAL PUBLICATIONS

Anderson, D.T., Anderson, C.D. and Misra, K.S.
1985: Use of VLF data in an integrated remote sensing interpretation in north central Manitoba; Ninth District Four Meeting, Thompson, Program with abstracts, p. 17.

Augsten, B., Thorpe, R., Harris, D. and Fedikow, M.A.F.
1986: Opaque mineralogy of the stratabound Agassiz Au-Ag deposit, Lynn Lake, Manitoba; Canadian Mineralogist, v. 24, pt. 2.

Ayres, L.D., Thurston, P.C., Card, K.D. and Weber, W.
1985: Archean supracrustal sequences: An Introduction and Perspective; in Evolution of Archean supracrustal sequences, L.D. Ayres, P.C. Thurston, K.D. Card and W. Weber, editors; Geological Association of Canada Special Paper 28, p. 1-6.

Baldwin, D.A., Syme, E.C., Zwanzig, H.V., Gordon, T.M. Hunt, P.A. and Stevens, R.P.
1985: U-Pb zircon ages from the Lynn Lake and Rusty Lake metavolcanic belts, Manitoba: Two ages of Proterozoic magmatism; Geological Association of Canada-Mineralogical Association of Canada, Joint Annual meeting, Fredericton, Program with Abstracts, v. 10, p. A3.

Cerny, P. and Meintzer, R.E.
1985: Fertile granites in the Archean and Proterozoic fields of rare-element pegmatites: crustal environments, geochemistry and petrogenetic relationships: Abstract; CIM conference on "Granite-related mineral deposits", Halifax, Abstracts 37-40.
in press: CIM Special Volume "Granite-related mineral deposits". (Title as above).

Cerny, P., Pentinghaus, H. and Macek, J.J.
1985: Rubidium microcline from Red Cross Lake, northeastern Manitoba; Bulletin of Geological Society of Finland, 57, Part 1-2; p. 217-230.

Corkery, M.T.
1985: Geological evolution of the Cross Lake supracrustal belt with emphasis on titanium-vanadium-bearing ilmenite-magnetite layers within an anorthosite complex; CIM Ninth District Four Meeting, Thompson: Program with abstracts, p. 17.

Doyle, P.
1985: Mineral exploration in Manitoba; CIM Ninth District Four Meeting, Thompson; Program with abstracts, p. 10.

External Publications Cont'd

Dredge, L.A. and Nielsen, E.
1986: Gold concentrations in till, Great Island, northern Manitoba; in Current Research, Part A; Geological Survey of Canada, Paper 86-1A.

Ercit, T.S., Anderson, A.J., Cerny, P. and Hawthorne, F.C.
1986: Bobfergusonite — a new primary phosphate mineral from Cross Lake, Manitoba; Canadian Mineralogist, *24* (in press).

Ercit, T.S., Hawthorne, F.C. and Cerny, P.
1986: The crystal structure of Bobfergusonite; Canadian Mineralogist, *24* (in press).

Fedikow, M.A.F.
1985: Rock, basal till and vegetation geochemical signatures of the Agassiz stratabound Au-Ag deposit, Lynn Lake, Manitoba; International Geochemical Exploration Symposium, Program with abstracts, p. 54.

Fedikow, M.A.F., Baldwin, D.A. and Taylor, C.
in press: Gold mineralization associated with the Agassiz Metallotect and the Johnson Shear Zone, Lynn Lake greenstone belt, Manitoba; CIM Symposium on gold in the western Shield.

Green, A.G., Hajnal, Z. and Weber, W.
1985: An evolutionary model of the western Churchill Province and western margin of the Superior Province in Canada and the north-central United States; Tectonophysics, v. 116, p. 282-322.

Green, A.G., Weber, W. and Hajnal, Z.
1985: Evolution of Proterozoic terrains beneath the Williston basin; Geology, v. 13, p. 624-628.

Hosain, I.
1985: Gradiometer interpretation of the Flin Flon mineral belt; CIM Ninth District Four Meeting, Thompson, Program with abstracts, p. 18.

MacArthur, J.D., Anderson, A.J., Ma, X.-P. and Palmer, G.R.
1986: PIXE analysis of apatite from granitic pegmatite dykes near Cross Lake, Manitoba; 11th IXCOM Conference, London, Ontario (submitted).

McRitchie, W.D.
1986: Geological program highlights: Geological Services Branch, Manitoba Energy and Mines; Provincial Geologists Journal 1985, v. 3, p. 39-42.

Turek, A., Carson, T.M., Smith, P.E., Van Schmus, W.R. and Weber, W.
1986: U-Pb zircon ages for rocks from the Island Lake greenstone belt, Manitoba; Canadian Journal of Earth Sciences, v. 23, p. 92-101.

Turek, A., Smith, P., Van Schmus, W.R. and Weber, W.
1985: Advances in the U-Pb zircon geochronology of the Island Lake greenstone belt, Manitoba; in Geological Association of Canada, Mineralogical Association of Canada, Joint Annual Meeting, Fredericton, Program with abstracts, v. 10, p. A64.

Wang, X.J., Cerny, P., Chackowsky, L.E. and Eby, R.
1986: Evolution of K-feldspar in the Red Cross Lake pegmatitic granite and its pegmatite aureole, northeastern Manitoba, Canada; International Mineralogical Association Meeting, Stanford, California, Abstract (submitted).

Table 14

Energy Consumption by Type of Fuel

Manitoba 1983-1985

(terajoules)

Type of Fuel	1983	%	1984	%	1985	%
Refined Petroleum Products	106,142	45.2	100,236	42.6	101,352	42.0
Natural Gas	70,163	29.9	74,007	31.4	76,494	31.7
Electricity	53,117	22.6	54,873	23.3	57,285	23.6
Coal and Coke	2,597	1.1	2,767	1.2	2,650	1.1
L.P.G.'s	2,292	1.0	3,089	1.3	3,095	1.3
Steam	493	0.2	427	0.2	272	0.1
TOTAL	234,864	100.0	235,399	100.0	241,148	100.0

Source: Statistics Canada, Manitoba Energy and Mines

Note: *Not adjusted for weather*

Table 15

Energy Consumption by End-Use*

Manitoba 1983-1985

(terajoules)

End-Use Sector	1983	1984	1985
Residential/Farm	47,223	49,240	52,463
Commercial	47,721	47,306	48,136
Industrial	35,842	37,711	38,806
Transportation			
Farm Machinery and Equipment**	14,277	9,267	9,829
Road**	47,833	53,426	53,519
Rail	10,582	10,723	11,114
Air	6,672	6,909	6,899
Marine	39	18	20
Sub-Total	210,189	214,600	220,786
Non-Energy Use***	5,215	3,855	3,924
Energy Industry Use, Losses and Adjustments	19,460	16,944	16,438
TOTAL	234,864	235,399	241,148

SOURCE: Statistics Canada, Manitoba Energy and Mines

* *Not adjusted for weather.*

** *A substantial part of the change in consumption in 1983 as compared to 1984 is a result of a change in reporting practices.*

*** *Products such as asphalt and lubricating oils and greases which are used for purposes other than their energy content.*

Table 16

Federal/Provincial ENERDEMO Agreement Summary of Expenditures by Project

April 1, 1985 — March 31, 1986

Project	Expenditures*
Methanol Fuel Test Study	$ 1,213.4 7
Residential Groundwater Heat Pump (Fredericks)	1,265.11
Manitoba Rolling Mills Reheat Furnace Energy Recovery	14,782.43
Retrofitting of Six Rural Arenas	6,909.94
Small Scale Demonstration Projects	1,701.20
Retrofit 120 Residences — Energy Demo	2,920.23
Retrofitting of four Urban Recreation Centres	2,353.16
Anti-Idling Device — Manitoba Trucking Association	2,887.34
School Retrofit Program — Enerschool	16,714.54
Town Energy Conservation Program (TEAM)	1,284.35
Flair Ten Home Demonstration Project	1,220.10
Hospital Retrofit Program (Enerhosp)	404,114.04
Miscellaneous Projects***	4,068.18
TOTAL	$461,434.09**

* *The amount shown in the Expenditure column for each project relates to the fiscal year 1985/86 and does not include money which might have been spent prior to April 1, 1985.*

** *Not included in this total are $0.3 million in administrative costs.*

*** *Ten additional projects with individual expenditures of less than $1,000 each.*